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MODEL Airplane NEWS

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MODELTECH SE-5A ARF

EROBATIC CHALLENGE
21 TOP PILOTS SHOW THEIR STUFF

6 IN-DEPTH REVIEWS

- Seagull Model **Harrier 3D** >> Cermark **Javelin II**
- Experimental Aircraft **Zodiac XL**
- Century Helicopter **Hummingbird CP**
- O.S. **FL-70 4-stroke** >> ModelTech **SE-5A**

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MARCH 2005

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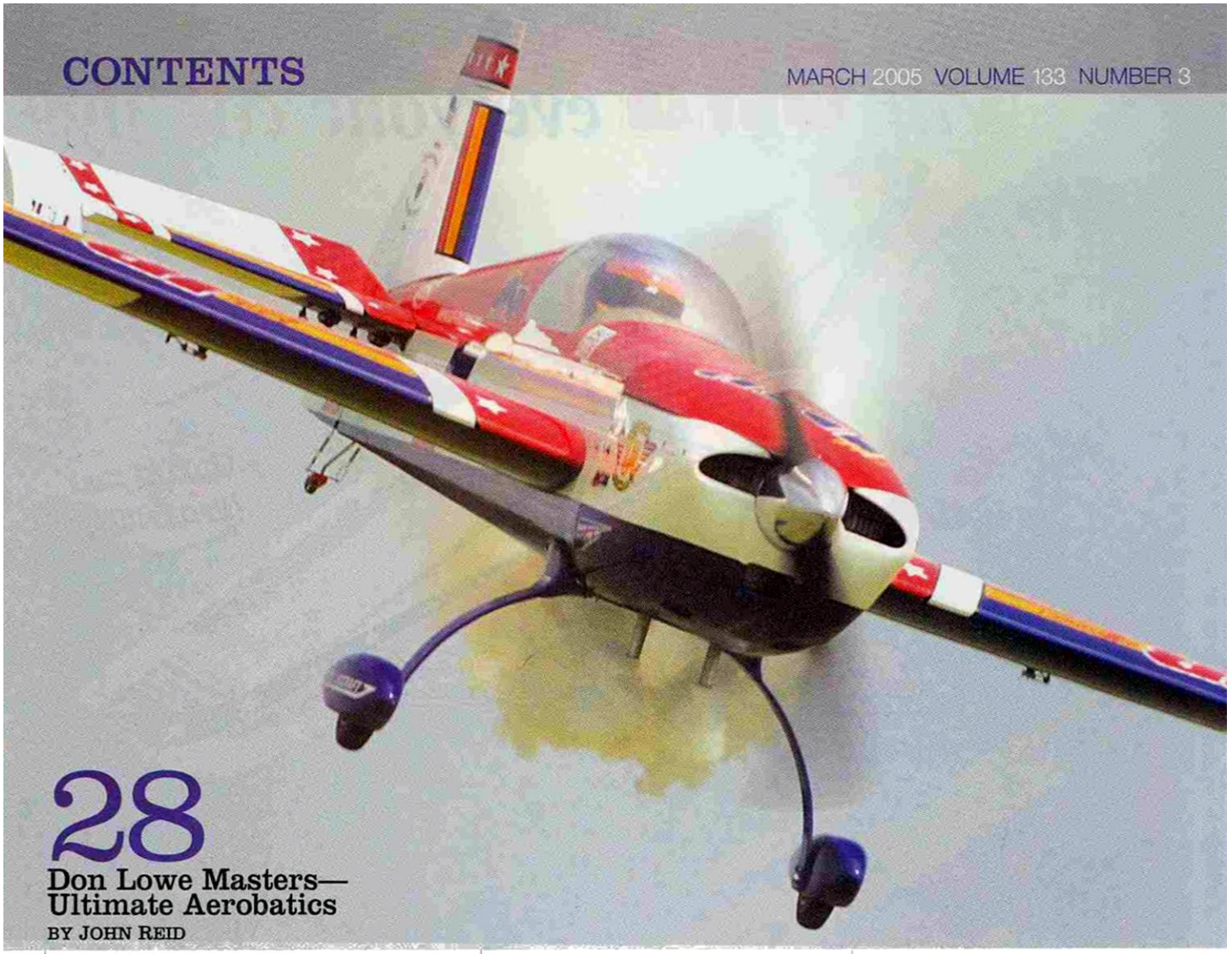

ON THE COVER: the ModelTech SE-5A ARF from Global (page 44; photo by John Reid).
ON THIS PAGE: Andrew Jesky's Extra 330 at the Don Lowe Masters (page 28; photo by John Reid).

HARNESS THOSE HORSES!

TO PERFORM AT ITS BEST, a fuel-powered airplane needs a strong, secure engine installation. If you do the job right, not only will you minimize noise and vibration, but you'll also ensure that maximum power is transferred to the propeller to pull your model through your favorite aerobatic moves. Some important installation considerations include proper engine cooling, choosing the right mount and hardware and setting up offset thrust. Sound complicated? It won't be after you've read "Engine Tech: Your Guide to Engine Installations," in which senior tech editor Gerry Yarrish takes you through each of these important topics. Check out his tips and techniques for engine mounting on page 87.

There's something for everyone in this month's product reviews. To start, we offer a full evaluation of the long-awaited Great Planes RealFlight G3 flight simulator. With even better graphics and enhanced physics, this computer program is guaranteed to keep your thumbs nimble this winter. See our in-depth evaluation on page 36 and get hooked on "no-fear flying"! Ever wished that you could be inside your model's cockpit so that you would really know what's happening during flight? The latest offering from Eagle Tree may be the next best thing: it monitors your plane's speed, altitude, rate of climb, servo glitches and just about everything else you could ever want to know about your model and then transmits the information back to your laptop at the field! This unique onboard system is definitely at the top of our "cool gadget" list, so you won't want to miss our review in this issue. Four-stroke enthusiasts have a lot to cheer about in the latest powerplant from O.S. Engines—the FL-70. In his detailed review, model-engine specialist David Gierke shares his dyno-test results and adds to your engine knowledge. Why does he think the FL-70 is such a revolutionary design? Turn to page 100 to find out.

The 20th Century Fox remake of "Flight of the Phoenix" is definitely on the *Model Airplane News* list of must-see movies. How often is an airplane modeler prominently featured on the big screen? And if the storyline alone wasn't enough, the movie also features some great-looking RC model planes! We were lucky to catch up with David Roberts of South Africa, who built three Phoenix models that were used on the set. Check out how "model magic" helped bring this movie to life in the "Final Approach" column.

Safe landings.

Debra Cleghorn

Executive Editor

MODEL Airplane NEWS
Est. 1929

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"... [your] articles and reviews are always informative and current. *Model Airplane News* is absolutely the best RC magazine on the market.

GREAT NEW LOOK

The new look of my favorite RC publication is wonderful! I find *Model Airplane News* very reader-friendly. The articles and reviews are always informative and current. I noticed that the January 2005 issue seemed to be easier on my eyes. Different paper or finish, maybe? Whatever the case, *Model Airplane News* is absolutely the best RC magazine on the market. Thanks for a great publication.

BOBBY PATTERSON, POINT PLEASANT, WV

Bobby, thank you very much for the words of encouragement. Everyone on our staff works tirelessly to produce the very best magazine possible. The new look is not a change of paper quality but simply a fresh design. We occasionally change our "look" to update the magazine's appearance. Thanks for noticing! GY

U.S. SCALE MASTERS CHAMPIONSHIPS

The February 2005 *Model Airplane News* article on the U.S. Scale Masters Championships was excellent. I have a question, though: where can I get more information about the qualifying events? I'd really like to check out some of these planes up-close and personal. Also, will the 2005 event be held at the Gardner Municipal Airport in Kansas again ?

STEVE LEVIN [EMAIL]

Steve, for updated information on the 2005 Scale Masters qualifiers, check scalemasters.org. These events are a great opportunity to see beautiful models and talk to some of the country's top craftsmen. I look forward to seeing you and all the new qualifiers at the 26th Championships, which will be held at Castle AFB, Atwater, CA. GY

TEXAN CLICK TRIP

In the January 2005 "Airwaves," it says that the plans included in the December 2004 issue were printed incorrectly and that readers could download a correct version from the *Model Airplane News* website. But the only place I see the plans is in the RC Store section, where

they are for sale. Where can I find the downloadable plans?

RYAN KRAAI [EMAIL]

Ryan, to find the Nick Ziroli T-6 Texan plans, go to the Click Trip section on the site: modelairplanenews.com/click_trips/click_index.asp. There, you will find all of our extended articles, including Nick's electric-powered Texan and other downloadable plans. Hope this helps! GY

TRIPLANE FAN

Greetings from Down Under! At the moment, I am building a Fokker DR.I triplane from a Flair kit, and when I've finished it, I plan to build a more scale one from the Glen Torrance Models kit. On page 51 of the May 2003 issue, you showed a triplane with a color scheme that's very appealing to me. Is that an authentic WW I scheme or one from today? And—as it cannot be seen in the picture—how is the triplane colored underneath?

JACQUES BOOSTEN [EMAIL]

Jacques, we're always pleased to hear from our Australian readers. The orange, green and white triplane in Budd Davisson's sidebar is a modern replica that's powered by a more readily available radial engine. The colors you see on top are the same as underneath the wings, but this scheme is not documented as an authentic WW I paint scheme. For good Fokker triplane documentation, check out the Windsock Datafile Specials from the folks at Wise Owl Publishing; call them at (562) 461-7574, or check their website—wiseowlmagazines.com. There are several Fokker triplane books in the series. They're filled with scale drawings, paint schemes and color reference information—perfect for the serious triplane lover! GY

MEMORIES OF JO KOTULA

Your January 2005 cover brings back fond memories of when I met Jo Kotula. I was working for an advertising agency in New Jersey. Jo was doing freelance artwork for the Curtiss-Wright account for us. He would come in and chat, sometimes bringing a very young Keith Ferris with him. One lunch hour, in his Piper Cub, he took me for my first plane ride out of a small airport in Totowa, NJ. He was a wonderful artist and friend.

PAT REILLY TAFRA [EMAIL]

I'm glad you enjoyed the trip down memory lane, Pat. Jo was truly an exceptional aviation artist, and we're sure that our January commemorative Jo Kotula covers will continue to inspire a new generation of modelers. DC

WRITE TO US! WE WELCOME YOUR COMMENTS AND SUGGESTIONS. LETTERS SHOULD BE ADDRESSED TO "AIRWAVES," *MODEL AIRPLANE NEWS*, 100 EAST RIDGE, RIDGEFIELD, CT 06877-4606 USA; EMAIL MAN@AIRAGE.COM. LETTERS MAY BE EDITED FOR CLARITY AND BREVITY. WE REGRET THAT, OWING TO THE TREMENDOUS NUMBERS OF LETTERS WE RECEIVE, WE CANNOT RESPOND TO EVERY ONE.

Top Flite P-51D .60

Bill Powell
Zebulon, NC

Bill's wonderfully detailed "Honey Bee" creates quite a buzz around the airfield. It is a replica of his friend's WW II P-51 fighter plane; it's powered by a .90 SuperTigre engine and has Robart retracts and struts. This 9-pound model's handsome finish is Duplicolor and Hobby Poxy over fiberglass. Bill created some of the decals on his home computer to complement those supplied by Top Flite.

Hughes H-1 Racer

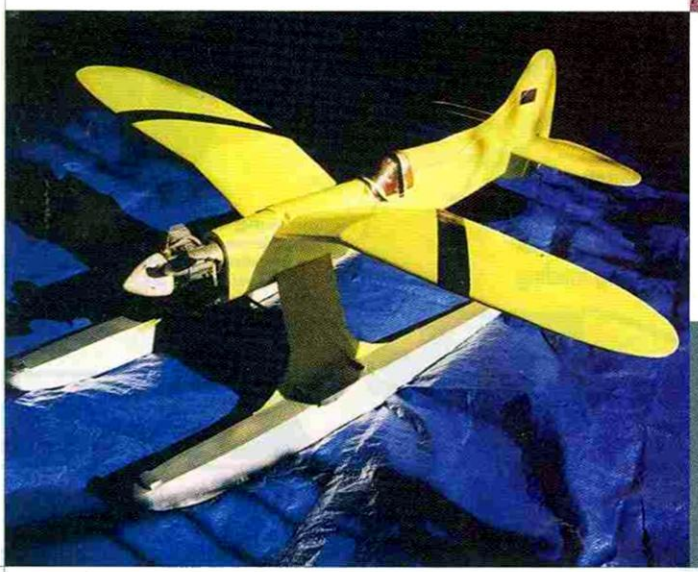
Greg Minden
Las Vegas, NV

Covered with chrome UltraCote and sporting a fiberglass cowl covered with Flite Metal, this gorgeous H-1 Racer looks the part. Greg describes his new model as "... very, very fast—just like it should be." With Robart retracts and a Moki 1.80 engine, we believe it. Greg did a fantastic job building his racer to 1/5 scale with a wingspan of 77 inches.

de Havilland Beaver

Billy Hare
Charlotte, NC

Can you believe that this gorgeous de Havilland Beaver is the work of a 16-year-old? Well, this young modeler perfected his Beaver over the course of a year, custom-building the cockpit and designing the decals himself. With a wingspan of 96 inches and weighing 18 pounds, this model is powered by a Zenoah G-26 engine. Billy noted that his Beaver is a "... great flyer that is very Cub-like with lots of rudder."



Swoose

Martin O'Neill
Placentia, CA

Dreamt up in the early '60s, this groovy model sports a 63-inch, gull-like wingspan and is powered by a .61 SuperTigre engine with a Futaba radio. Martin describes his Swoose as a "smooth flyer" that can easily be converted into a standard plane with wheels.

SEND IN YOUR SNAPSHOTS. *Model Airplane News* is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable, but please do not send digital printouts or Polaroid prints. Emailed submissions must be at least 300dpi. We receive so many photographs that we are unable to return them. All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of the year. The winner will be chosen from all entries published, so get a photo or two, plus a brief description, and send them in! Send those pictures to "Pilot Projects," *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA.

Illustrations by Richard Thompson

blind leading the blind

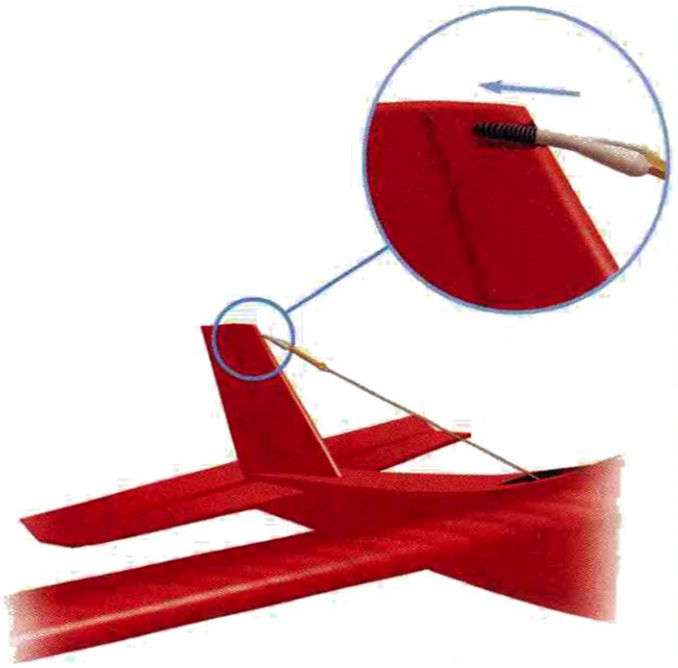
Need to drill some blind holes, but you don't have a depth gauge? Here's a quick and easy way to make one. Cut a wooden dowel to the needed length. Drill a hole through the center of the dowel (if possible, use a drill press for this). Slide the dowel over your drill bit until the tip of the exposed bit drills a hole of the needed depth. As you drill your hole and the dowel touches the surface, you'll know the hole is the proper depth.

Edward Hazlett, Cherry Tree, PA

get a grip

Pulling apart a Deans Ultra connector can be difficult because of the connector's smooth surface. To gain a better grip, cut some sandpaper, and glue it to the sides of the connector; 60-grit works well. The connectors will now be easy to grip and pull apart.

Dean Shepherd, Sandy, UT



all strung out

For maximum reception, the receiver antenna should be extended to its full length outside the airplane. Here's a tidy way to tie it off and keep it out of harm's way. Drill a 1/16-inch-diameter hole in the leading edge of the vertical fin near the top; it should be 3/4 inch deep. Take a 1-inch length of threaded 2-56 rod, and screw a nylon clevis onto one end. Screw the rod into the fin, remove it and harden the hole with a few drops of thin CA. After the CA has dried, reinsert the rod into the hole, extend the antenna and tie it to the clevis with a small rubber band.

Stratton Gatzimos, Merrimack, NH

positive control

When making arrow-shaft, dowel, or square-balsa pushrods, put the wire extensions on opposite sides of the pushrod. When assembled this way, the pushrods will not bend under compression and will provide more positive control-surface movement.

Stan Zdon, Coon Rapids, MN

SEND IN YOUR IDEAS. *Model Airplane News* will give a free, one-year subscription (or a one-year renewal, if you already subscribe) for each idea used in "Tips & Tricks." Send a rough sketch to *Model Airplane News*, 100 East Ridge, Ridgefield, CT 06877-4606 USA. BE SURE THAT YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH ITEM YOU SUBMIT. Because of the number of ideas we receive, we can neither acknowledge each one nor return unused material.

>GREAT PLANES MODEL MFG.
MATT CHAPMAN .46 CAP 580

Now Great Planes offers the same great looks and high-quality construction as its 1/3-scale CAP 580 in a sportier, .46- to .70-size airframe. With MonoKote covering, a painted fiberglass cowl and wheel pants and a generous hardware package, this 55-inch-span aerobat is destined to become one of your favorites. Dual ailerons ensure positive control in the air. Specs: wing area—562.5 sq. in.; weight—6.75 to 7.5 lb.; requires a 4-channel radio. Price—$200.

Great Planes Model Mfg.
(217) 398-6300; (800) 682-8948;
greatplanes.com.

>CARL GOLDBERG PRODUCTS
SHOCK 3-D ARF

Looking for all-out 3D performance? Designed to be powered by a brushless motor and a 3-cell Li-poly pack, the Shock 3-D is capable of the entire range of full-stall, thrust-vectored maneuvers: torque rolls, waterfalls, harriers, high-alpha rolls; you name it! It features lightweight wood construction, iron-on covering, landing gear, wheels, plastic canopy and decals. Specs: wingspan—39.25 in.; length—36.25 in.; radio required—4-channel w/4 microservos.

Carl Goldberg Products
(678) 450-0085; carlgoldbergproducts.com.

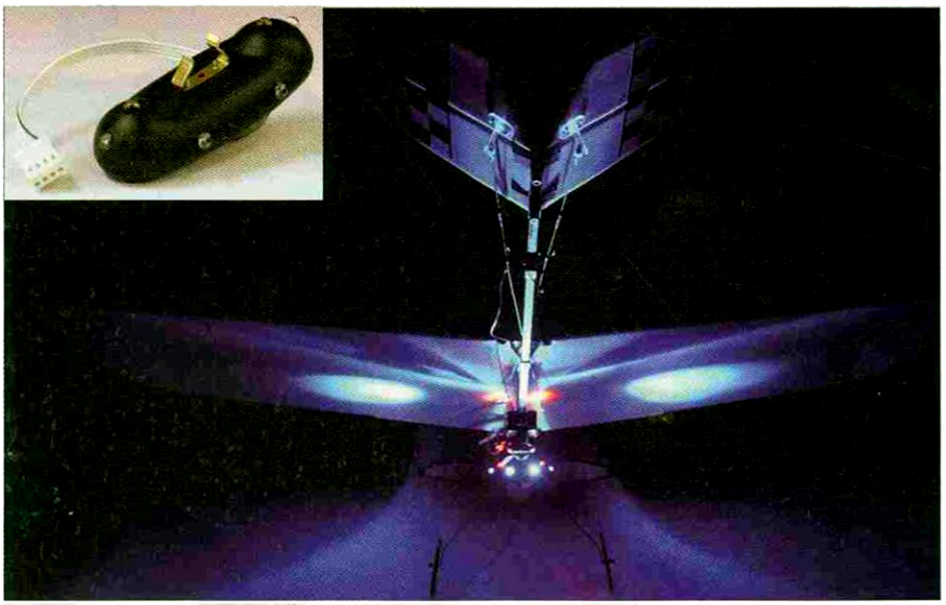
>KONDOR MODEL PRODUCTS
DH-2 BEAVER

With an 8-foot wingspan, this classic floatplane is guaranteed to turn heads at the lake! The 17-pound model features a fiberglass fuselage and floats and laser-cut balsa wing and tail. Add a 1.50 4-stroke (or G-26 gas engine, if you prefer) and a 5-channel radio with 7 servos and then head to the lakeside for some splash-and-go's. The DH-2 Beaver costs $550, including floats.

Kondor Model Products
(253) 859-7788;
(888) 761-0500; kmp.ca.

➤GREAT PLANES MODEL MFG.
YAK 55 3D

Don't be fooled by its size; this 33-inch-span park flyer has giant-scale performance! It can fly almost any maneuver, nearly anywhere, so you'll want to keep it in your car for "grab-it-and-go" flying. The Yak 55 features a durable, lightweight EPS foam airframe, Depron aileron, rudder/fin and stabilizer halves and carbon-fiber tube reinforcement. Just mount the included 280 motor and install your radio gear in the precut holes, and this exciting aerobat can be flight-ready in just 2 or 3 hours. The best part? Its price—$50! Now that's a bargain.
Great Planes Model Mfg. (217) 398-6300; (800) 682-8948; greatplanes.com.



➤HOBBYZONE
NIGHT-FLIGHT MODULE

Extend your flight time with HobbyZone's super-bright Night-Flight Module! This lightweight unit is easy to attach to any X-Port-enabled HobbyZone and ParkZone plane, including the HobbyZone Firebird Commander, Aerobird Challenger and ParkZone Slo-V. Then use your transmitter to activate one of four LED settings and put on a show. The Night-Flight Module costs just $20.
HobbyZone; distributed by Horizon Hobby Inc. (217) 352-1913; horizonhobby.com.

➤IKARUS USA
AEROFLY PROFESSIONAL DELUXE

Become a better pilot with this new and improved flight sim from Ikarus USA. Its photo-realistic, 360-degree scenery will make you feel as if you're at the flying field. The Aerofly Pro Deluxe features 12 airfields, split-screen capability, cockpit-mode setting, flight recording, playback and more. It has more than 50 detailed, gas- and electric-powered models, including F3A planes, 3D aerobats, helicopters, trainers, sailplanes and jets. It costs $170.
Ikarus USA (239) 690-0003; aeroflypro.com.

ICARE
MADNESS 2

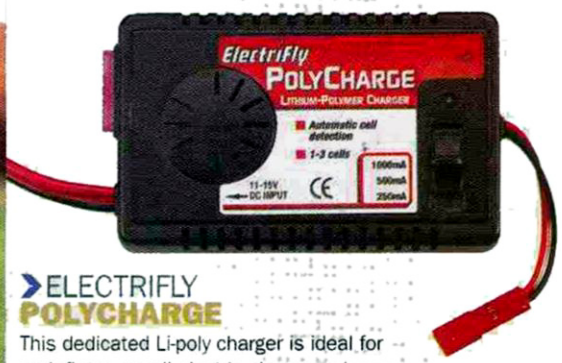
This model's exceptionally wide speed range and outstanding power-to-weight ratio give it unlimited aerobatic ability. It features all-wood, built-up construction, large control surfaces and a unique slide and bolt-on cowl for easy access to the motor and battery. A Plettenberg Orbit 25-18 outrunner brushless motor and a 5S3P Li-poly battery are recommended. Specs: wingspan—59 in.; wing area—1,008 sq. in.; wing loading—10.2 oz./sq. ft.; weight—4 to 4.5 lb. The Madness 2 EP ARF costs $300.
Icare (450) 449-9094; icare-rc.com.

VMAR
TIGER ARROW

The folks at VMAR have a reputation for making sport ARFs that have great looks and high performance with a budget-minded price tag, and this latest offering is no exception. Like all VMAR planes, the Tiger Arrow features all-wood construction and Polycote ECS covering, which has embedded graphics for easier cleaning and non-curling decals. Available in red and transparent yellow, the Tiger Arrow also comes with a preinstalled engine mount that's ready for your favorite .45 to .52 engine. Specs: wingspan—54.5 in.; wing area—610 sq. in.; length—49 in.; weight—5.25 to 5.5 lb.; radio required—4-channel w/5 servos. The Tiger Arrow costs $130.
VMAR; distributed by Richmond RC (877) 727 2329 or (604) 940-1066; richmondrc.com.

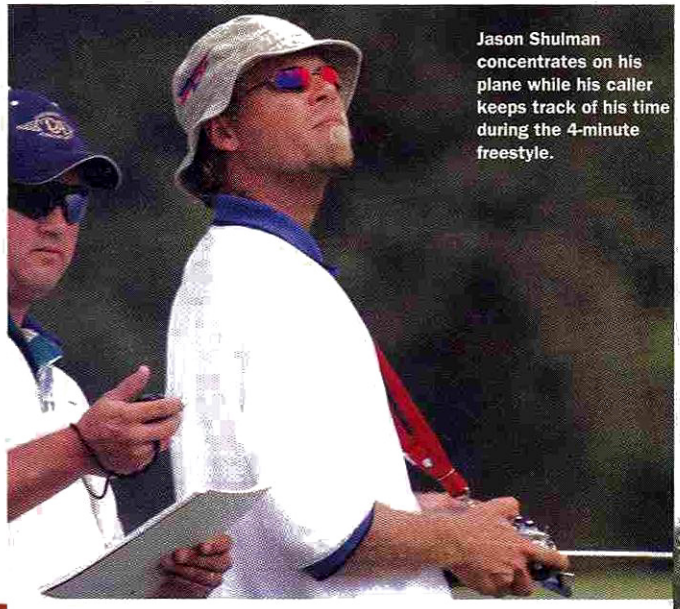
PROCTOR ENTERPRISES
¼-SCALE 1929 FLEET BIPE MODEL-1

This impressive prototype model is built to 27-percent scale, so it can be powered by a Siedel 7-cylinder radial engine, but the production kits are 25-percent scale. Wingspan is 84 inches, and the fuselage is 74 inches long. The kit includes a bolt-together landing-gear assembly (no soldering required), and the hardware pack includes all the scale fittings. The kit comes with material to build several rudders for various aircraft model types.
Proctor Enterprises (503) 678-1300; proctor-enterprises.com.



ELECTRIFLY
POLYCHARGE

This dedicated Li-poly charger is ideal for park flyers, small electric planes and helis. Designed specifically for 1- to 3-cell packs, it automatically detects the number of cells in each pack and charges at a constant current and voltage. It can be set for 250, 500, or 1000mA and features a high-intensity blue LED and buzzer to indicate charge status. Its size (2.2x0.9x3.5 inches) and weight (just 4.35 ounces) make it very portable. It uses 11 to 15 volts DC power and has alligator-clip connectors. With a price tag of just $25, it's one charger you can't afford to be without!
ElectriFly; distributed by Great Planes (217) 398-6300; (800) 682-8948; electrifly.com.



Jason Shulman concentrates on his plane while his caller keeps track of his time during the 4-minute freestyle.

Don Lowe Masters

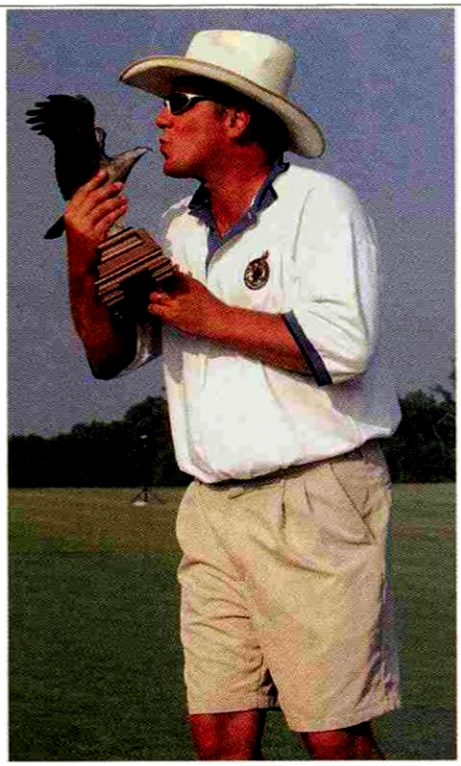
Ultimate Aerobatics!

BY JOHN REID

PHOTOS BY JOHN REID

Christophe Paysant-Leroux performs an outstanding 4-minute freestyle routine for the crowd.

Since the passing of Bill Bennett and the subsequent loss of the Tournament of Champions (TOC), many members of the aerobatic community have been looking for an event to rival the TOC's stature. One championship that is on a par with the TOC is the Don Lowe Masters. This aerobatic challenge is held in the Triple Tree Aerodrome in Woodruff, SC, and offers a total prize package of $50,000. Not many venues can match the beauty and grandeur of this site or the hospitality of its owners, Pat and Mary Lou Hartness. From its perfectly manicured putting-green runway to the full-size airplane hangar and scenic lake, this is the perfect venue for a Masters aerobatic championship.



Twenty-one of the top aerobatic pilots in the world were invited to compete at the 2004 Don Lowe Masters. Pilots from Georgia, Florida, Maine, Illinois, North Carolina, Arizona, Minnesota, Michigan, Ohio and Virginia represented the United States. Pilots from Germany, Canada, France and Italy added an international flavor.

The competition began under fair fall skies. All 21 contestants competed by flying the first rounds of the known, unknown and 4-minute freestyle competitions. By the end of the day, Quique Somenzini held the top spot, with Jason Shulman, Christophe Paysant-Leroux, Mark Leseburg, Mike McConville, John Glezellis and Sebastiano Silvestri rounding out the top seven.

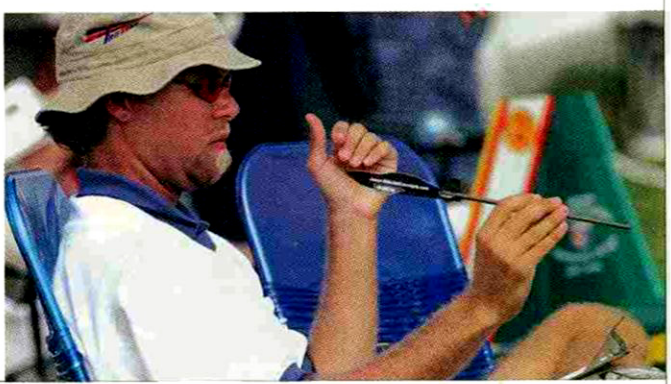
Day two was a different story. In the morning, a very heavy, thick fog settled over the Triple Tree Aerodrome. At 10:30, a test plane took off; it flew straight up into the fog and immediately disappeared. By noon, however, the fog had lifted sufficiently to allow the competition to start. Again, all the competitors flew the second rounds of the known, unknown and 4-minute freestyle. Throughout the day, precision flying dominated; many competitors even flew perfect rounds. In the end, though, only the top seven pilots would make it to Sunday's finals.

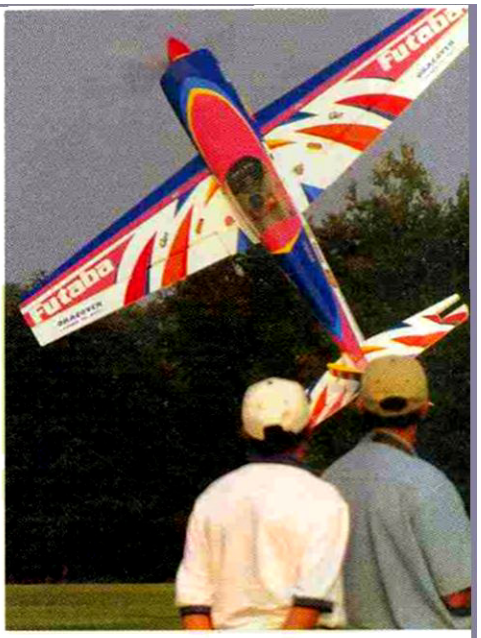
Saturday's competition ended at sunset. Competitors, judges and spectators headed to the aircraft hangar to enjoy a delicious barbecued-chicken dinner. Afterwards, the names of the seven finalists were announced. Quique Somenzini held the top spot, followed by Christophe Paysant-Leroux, Jason Shulman, Mark Leseburg, Sebastiano Silvestri, Chip Hyde and Peter Goldsmith. Mike McConville missed the top seven by a mere 0.33 point, while Bill Hempel missed by only 0.59 point.

The final day of competition was again delayed because of thick fog, but the proceedings got under way by noon, and the crowd was treated to some outstanding flying throughout the day—especially during the 4-minute freestyle. The competition ended just before nightfall, and while the volunteers assembled the stage for the awards presentation, the crowd was treated to photo ops with the pilots and planes. At last, after all of the scores had been totaled, the awards (and the prize checks!) were handed out. Retaining his top position by a mere 1.84 points—and earning the top prize of $20,000!—was Quique Somenzini. Jason Shulman barely beat out Christophe Paysant-Leroux for second by a scant 0.12 point. They, along with Chip Hyde, Mark Leseburg, Sebastiano Silvestri and Peter Goldsmith, comprised the top seven.

The Don Lowe Masters is the type of event that every model airplane enthusiast should plan to attend at least once. But be forewarned: once you've seen the Triple Tree Aerodrome facility, you'll want to come back again and again! The next Don Lowe Masters will be held in '06; check the Joenall.com website for more information. See you there!

> **The Don Lowe Masters** is the type of event that **every enthusiast** should plan to attend.

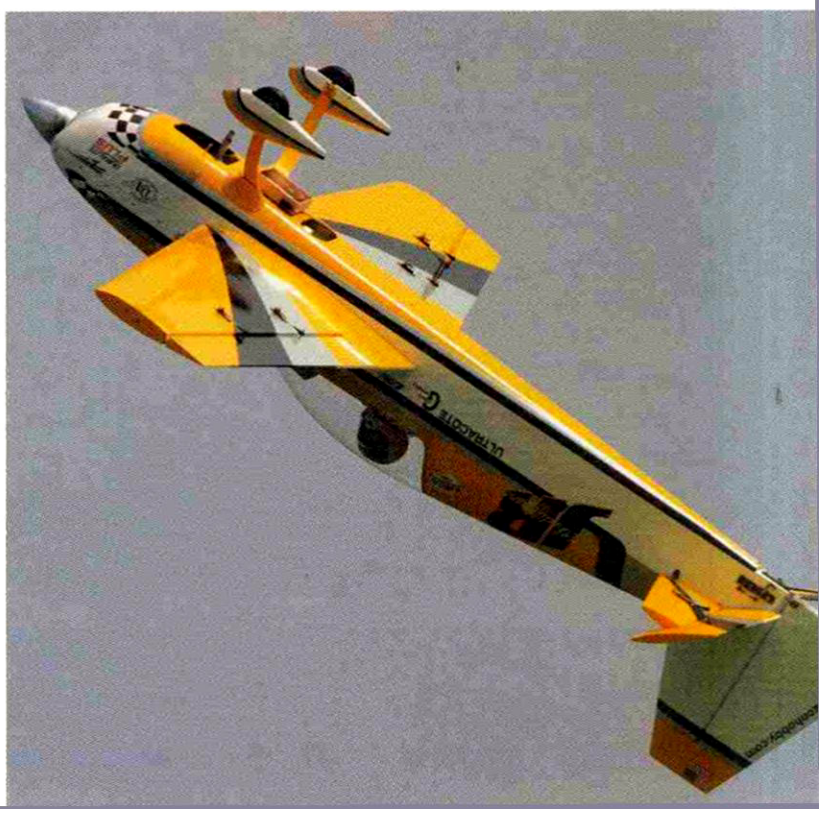


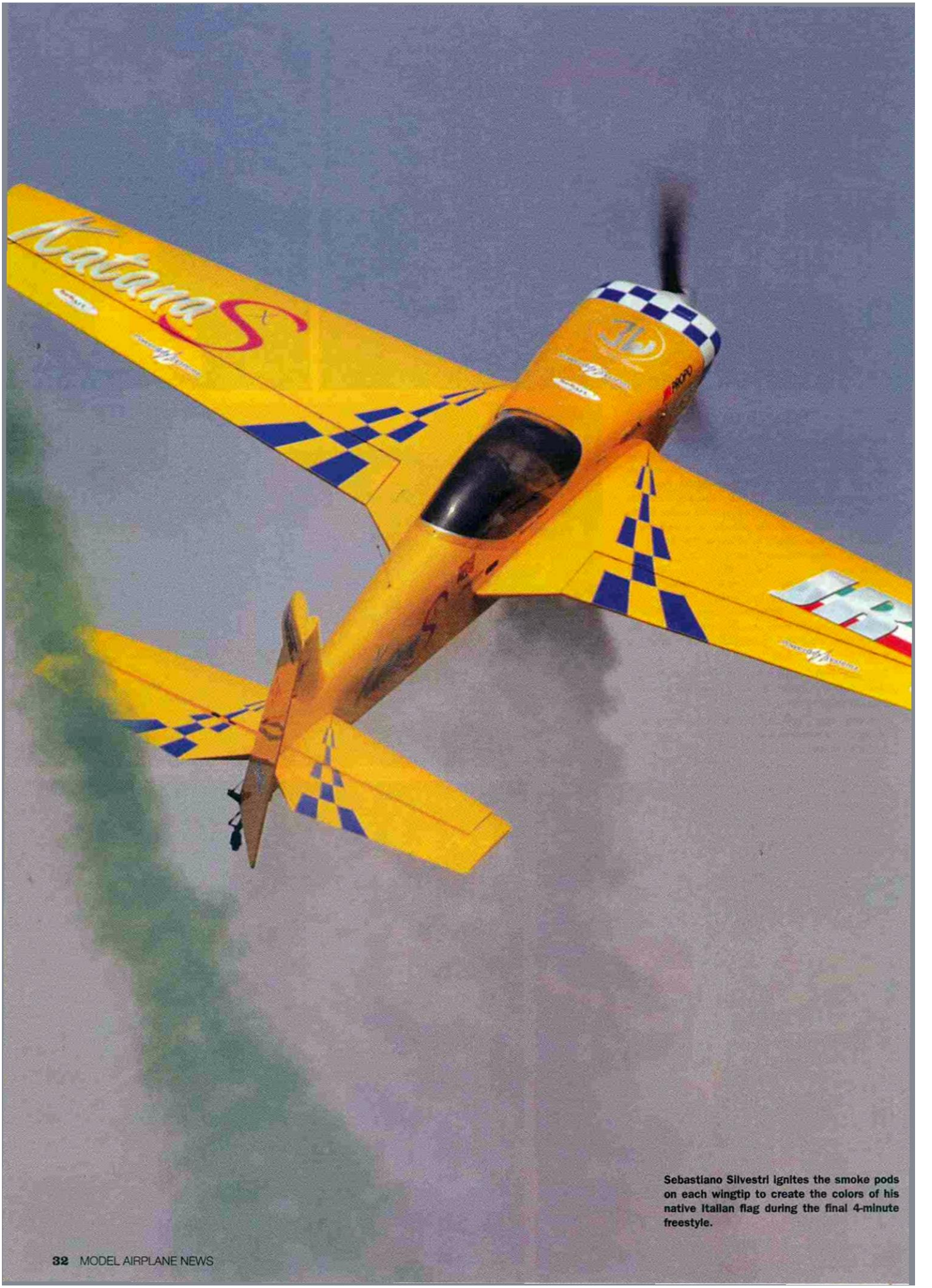


Clockwise from above: Jason Shulman's aircraft during the 4-minute freestyle. To give his plane the added maneuverability needed for 3D moves, he adds tail weight, installs a lighter prop and removes the spinner to shift the balance aft. • Christophe Paysant-Leroux and his caller watch his plane pass by during a knife-edge maneuver. • The top seven pilots chat while they await the winners' announcement. Left to right: Silvestri, Shulman, Leseburg, Goldsmith, Hyde, Paysant-Leroux and Somenzini. • Mike McConville's plane does an inverted Harrier during the 4-minute freestyle. • Quique Somenzini hovers his plane on deck with the smoke on. Before too long, the plane was completely engulfed in a cloud of smoke!

Opposite page, center: the "mouth of the South," announcer Bill Sadler demonstrates his true feelings about the first-place trophy.

Opposite page, bottom: in a quiet moment, Jason Shulman reviews his sequence before stepping up to the flightline.





Sebastiano Silvestri ignites the smoke pods on each wingtip to create the colors of his native Italian flag during the final 4-minute freestyle.

Andrew Jesky's Carden Aircraft Extra 330 makes a low pass with full smoke on.

Winners

PILOT	AIRCRAFT	RADIO	ENGINE
Quique Somenzini	Somenzini Yak-54	JR	3W-150
Jason Shulman	Composite ARF Extra 330	Futaba	ZDZ-160
Christophe Paysant-Leroux	ZN Line Extra 330	Futaba	DA-150
Chip Hyde	Composite ARF Yak	Futaba	DA-200 4-cylinder (prototype)
Mark Leseburg	Godfrey Extra 300L	JR	DA-150
Sebastiano Silvestri	Katana S	JR	DA 150
Peter Goldsmith	Own-design CAP	JR	DA-150
Mike McConville	Carden Aircraft Extra 330	JR	DA-150
Bill Hempel	Somenzini Yak-54	Futaba	3W-150
John Glezellis	Troybuilt Extra 260	JR	DA-150
Kurt Koelling	Carden Aircraft Extra 330	Futaba	DA-150
Don Szczur	Composite ARF Extra 330	JR	DA-150
Andrew Jesky	Carden Aircraft Extra 330	JR	DA-150
Jason Noll	Carden Aircraft Extra 330	Futaba	DA-150
Ivan Kristensen	Carden Aircraft Extra 330	Futaba	DA-150
Bernd Beschorner	European Ultimate	Multiplex	3W-200
Sean McMurtry	3W Extra 330	Futaba	3W-150
Brian Hannah	3W Votec 322	JR	3W-150
Ryan Evans	Carden Aircraft Extra 330	JR	DA-150
Andy Kane	Composite ARF YAK	JR	ZDZ-210
Ransom Fairchild	Composite ARF G202	JR	DA-150

Chip Hyde brings his Composite ARF Yak right down onto the deck so the crowd can admire its outstanding color scheme. This new plane was equipped with a 4-cylinder prototype engine from Desert Aircraft. +

WHAT'S NEW?

G3 has a long list of features, and after using the sim, my overall impression is that it's very good; the more I use it, the more I like it and its versatility. Don't compare it with G2, though; it's an entirely new simulator. Note that RealFlight G2 is not compatible with G3. The flight model (physics) is a 100-percent rewrite and is completely different from G2. All of the RealFlight Add-Ons (numbers 1 through 5), however, are compatible with G3 and will work with it. Installing the program is super easy; insert disc 1 and follow the on-screen prompts. The system will tell you when to insert disc 2 to complete the installation.

REALPHYSICS 3D If you're familiar with G2, you'll be right at home with G3's looks and basic functions. But that's where the similarity ends. The new RealPhysics 3D has really transformed this flight sim. Its ability to re-create the characteristics of model flying is uncanny. In fact, topnotch pilots Jason Shulman, Frank Noll and Mike Cross had a hand in providing input to the physics engine to develop the onscreen feel.

TRUFLO WIND DYNAMICS Although it's difficult to model, wind impacts every aspect of RC flying. The new flight dynamics provides the most accurate simulation of wind at a flying site. And like just about everything else in G3, the wind strength may be varied. For slope flyers, G3 includes models and sites to develop soaring skills. It's pretty neat how a model "bumps" as it encounters an updraft or a thermal.

ACCUMODEL AIRCRAFT EDITOR This is one of the biggest changes to the flight sim. It's one of the most powerful, flexible editors on any RC flight sim. It allows you to change virtually every aspect of your model. Want to make a turbine-powered NexSTAR or add smoke to the wingtips? AccuModel makes it easy. G3 is a component-based physics system in which you can add, delete and modify the wing, fuselage, wheel, engine, etc. When you edit a model, you work on a wire-frame representation of it, and the area you're working on is highlighted. When you make a change, it's reflected

G3 offers a great way to learn 3D maneuvers without risking your model.

A LOOK AT 3D

REALFLIGHT G3 HAS A LOT TO offer experienced and fledgling 3D fliers. The sim includes five 3D-capable aircraft: the CAP 232, the electric E3D, the Extra Special, the Ultimate bipe and the Yak-54. If you already own any of the five RealFlight Add-Ons, you have an even larger selection of 3D-capable planes. The Yak-54 comes in two versions—one with a gyro and one without. For those who are just getting into 3D aerobatics, the Yak-54 with the gyro is the perfect trainer; it will help you to perfect your hovering techniques. In stall attitudes that are so common when flying 3D aerobatics, the gyro helps to stabilize the plane.

G3 allows unlimited modifications to any of its planes: you can alter weight, move the CG and modify the control-surface throws and even the area of the control surfaces. This makes it much easier to practice 3D maneuvers with it. I found that if I modified a plane by decreasing its weight and moving its CG slightly aft, I had an easier time flying it at high angles of attack. Of course, how many modifications you make will depend on your flight skills.

Another advantage of practicing 3D maneuvers on a computer sim is that you don't have to worry about crashing. You can fly closer to yourself and to the ground. This proximity to the plane helps you to make flight corrections faster because you see the plane's minute attitude changes and can immediately react to them. On a flight sim, you can become proficient at 3D maneuvers within hours. This takes weeks or months if you practice with an actual RC aircraft.

For me, the Virtual Flight Instructor (VFI) is one of the best G3 enhancements. This expanded program includes flight instructions from Jason Shulman, Frank Noll and Jim Bourke. It allows you to listen to the instructor describe a maneuver while you watch a plane perform it. A transmitter in the upper right portion of the screen shows the stick movements throughout the maneuver. VFI allows you to fly a plane alongside the instructor's plane, so you can try to duplicate its movements. Though this is definitely a cool feature, it is very difficult to do because if your plane is not flying right next to the instructor's plane, it will disappear from view.

Jason Shulman covers many basic pattern maneuvers, including 4-point rolls, touch-and-go's, Immelmann turns and others. Frank Noll deftly shows us many 3D maneuvers, including the avalanche, rolling circles, torque rolls and Lomcevaks. Jim Bourke, the general manager of Knife Edge Software—developers of RealFlight G3—demonstrates sport aerobatics, among which are loops, snap rolls and 4-point rolls, and he introduces us to hovering.

Overall, the improvements that are evident in RealFlight G3—specifically, those for 3D aerobatic pilots—are well worth the investment. The program offers unlimited practice time, and the virtual flying is so close to the real thing that your thumbs will never know the difference. —*John Reid*

The Virtual Flight Instructor has been greatly expanded. Noted pilot Jason Shulman shows how to do basic pattern maneuvers.

Limbo is one of five events that you can challenge yourself or your friends to. It isn't as easy as it looks!

GP REAL FLIGHT

SPECIFICATIONS

Product: RealFlight G3
Distributed by: Great Planes Model Distributors

Minimum system requirements:

- Windows XP, 2000, ME, or 98 (Local administrator access required for Windows XP and 2000)
- Intel Pentium 1GHz or equivalent processor
- 256MB RAM (ideally, 512MB RAM)
- DirectX 9- (or better) compatible video and sound card
- 3D video card with at least 32MB RAM
- 1.3GB hard-drive space
- CD-ROM drive
- Super VGA monitor
- USB port

Price: $199.98

FEATURES

2 CDs; USB InterLink Plus Controller; adapter cords for Futaba, JR and Hitec transmitters; quick reference guide; 10 new flying fields with FlexiField Site Editor; 35 unique aircraft to fly; pull-down menu for instant changes; RealPhysics 3D; changing wind dynamics; unlimited editing capabilities; collision damage when model hits object; 3D objects; scenery; Virtual Flight instructor (VFI) teaching aid; compatible with all Add-Ons discs.

COMMENTS

RealFlight G3 is easy to install and easy to use. The graphics are stunning and the "feel" is better than ever. The AccuModel editor is extremely versatile and allows you to match your own RC models very closely.

Hits

- Easy installation and a very detailed electronic manual
- Excellent scenery rendition
- Exceptional flight performance and feel

Misses

- Helicopters not yet available

If soaring is your main interest, G3 has you covered; there are slope sites and gliders for hours of fun.

on the screen and is ready to be reviewed and revised.

The sim also includes full-coverage collision detection, the FlexiField flying-site editor, split screens, VirtualRevolution sound technology, Virtual Flight instructor, NavGuides viewports, multiplayer capability and a host of other features—far too many to list here.

AT THE VIRTUAL FIELD

The new graphics are very impressive: leaves gently wave in a breeze, and the shadows cast by objects constantly change as you move about. The programmers did a nice job of making it easy to change and remove objects from the flying sites. The airport editor is simple and quite intuitive to use, and the graphics show a huge improvement (and I thought the graphics in G2 were pretty realistic!).

I didn't initially appreciate the flight model because I thought that little had been changed. But after using the sim for a few days, the flight model really grew on me; you need to use it for a while to appreciate it fully. The 3D physics are simply amazing. G3 comes with a Yak-54 that I have been flying and whose flight characteristics are almost on the money. I had only to make minor adjustments to the exponential and control throws to get the plane to handle like similar planes I've flown. G3 handles 3D maneuvers such as hovering, waterfalls and harriers very well.

Torque rolling is more difficult on G3 than on G2 and other flight sims; I thought they made the maneuver too easy to be realistic. Making it difficult to torque roll makes the sim more challenging; it makes you practice harder, and that should give you better results at the flying field.

I really like being able to adjust the G3's parameters. The features with the software radio are very cool; I was able to create custom multi-point mixes just as I

G3's NexSTAR has all the bells and whistles of the real model—right down to the wing droops and the onboard AFS.

BEGINNER'S PERSPECTIVE

I'M A NEWCOMER TO RC AND HAVE JUST STARTED to fly. When I go to the flying field with my trusty Hobbico NexSTAR (a .46-powered trainer), the older fliers—the ones who aren't familiar with flight sims—are fairly impressed by my abilities. "It takes years to get reactions to that level," they say of my thumbs. "How did you do that?"

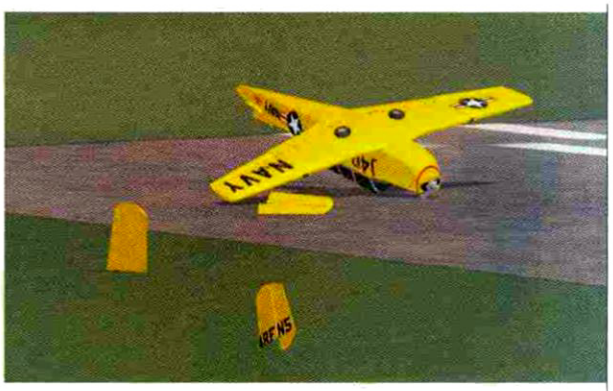
I'm tempted to respond that it's my natural gift as a pilot, but the truth is, I trained for hours and hours on RealFlight G2 before I hit the field, and it accelerated my progress considerably. That's why, as a novice, I was especially encouraged to see that the newest generation of RealFlight offers several features and refinements that are ideal for advancing the skills of beginners and intermediate pilots.

RealFlight G3 includes a virtual NexSTAR as one of its aircraft choices; this was previously available only with the purchase of the NexSTAR model. My 13-year-old son (also a beginner) and I share the NexSTAR, so we can now work with the virtual version and all the other aircraft we aspire to fly without having to switch programs. When flying the NexSTAR and other trainers, we've noticed that the improvements in the flight-sim's physics make the aircraft much less "floaty." This has helped us to develop our landing skills in a more realistic manner.

In addition to training for RC, G3 offers a good way to have some escapist fun, and the 10 new flying fields and 5,000+ square miles of new terrain offer ample opportunities for my son and his friends to tour a variety of environments in Chase Mode. While he delights in this "video game" approach of tearing through the many challenges like Luke Skywalker in "Star Wars," I use Chase Mode to set trims and to test the control-input sensitivity of unfamiliar aircraft before I switch to the RC perspective: Fixed Position. But my son and I agree on one point: RealFlight G3 is way better than Grand Theft Auto any day!

—Jon Chappell

The level of detail in G3 is fantastic; check out the panel lines and weathering!



When you crash in G3, your plane breaks—as this T-34 demonstrates.

WARBIRD DELIGHT

WHEN REALFLIGHT WAS FIRST INTRODUCED, it set a new standard for realism. Since then, flight sims have all improved, and RealFlight has continued to expand and refine its programming to maintain its edge. The second generation, RealFlight G2, with its plug-n-play USB InterLink controller enhanced the experience even more. With the new G3 version, RealFlight adds even more detail and realism to your computer-generated flight adventure.

I reviewed and have flown the Top Flite giant-scale P-51D Mustang ARF a great deal, and I was pleased to see it in G3's aircraft menu. I thought it would be interesting to compare it with the real model. After spending some time at the computer, I thought that G3's Big Beautiful Doll P-51 Mustang was very similar to its real counterpart. All of its functions are there: the usual flight controls (including high and low rates), retractable landing gear and flaps. G3's sound generator does a convincing job of letting you know that a big-block engine sits inside the cowl, and the graphics are stunning. I taxied the model close to my vantage point so that I'd be able take a really close look at it. All the controls moved realistically, and the entire experience was right-on. The nose art, wingtip and nose checkerboards, painted spinner, panel lines and grease smears; they're all there. There's even a pair of sequencing inner gear doors for the main gear! Hey! Those aren't on my model; I'm jealous!

With the flaps set at half, advance the throttle, and the model gets light on its feet quickly. Give a slight pull on the elevator, and it's airborne—just like my real-world model. While flying, I was completely convinced that I was controlling a real giant-scale Mustang. There was a little too much pitch stability and a little too much control response, but after a little editing on the wire-frame AccuModel, I had dialed in the feel of G3's Mustang to a very convincing level. Great Planes has a real winner on its hands with G3!

—Gerry Yarrish

"RealFlight G3 is easy to install and easy to use. The graphics are stunning, and the "feel" is **better than ever.** It's the perfect training aid for beginners, and it allows experts to practice new skills."

In the AccuModel Aircraft Editor, the models are shown as "wire" frames. Here's the Osprey from Add-On 5.

would with a high-end computer radio. I created a mix to remove the pitch coupling on the Yak-54, and it's very close to what you need on a real RC model Yak. As far as I can tell, you can change just about every physical parameter on the planes with the AccuModel editor, so you can create and modify the sim models to match your RC planes.

IN SHORT

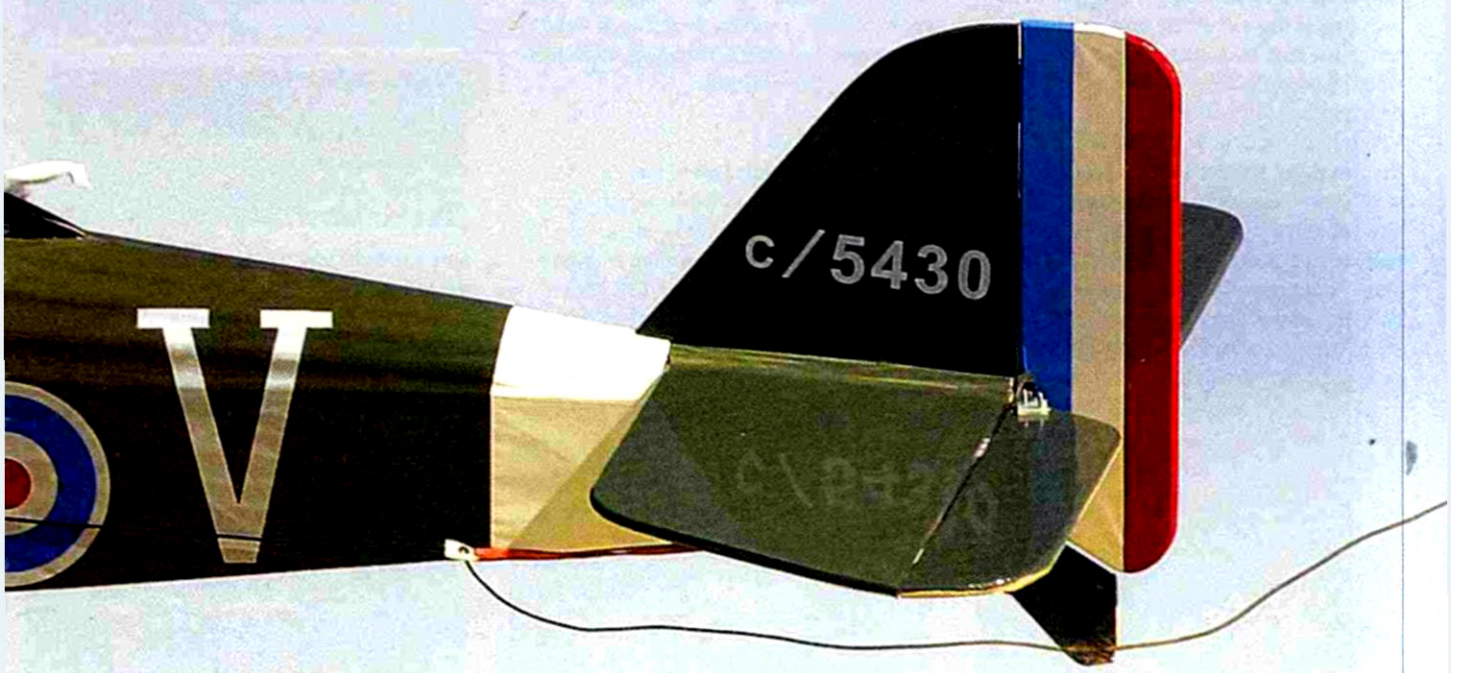
I am very pleased with RealFlight G3, and I highly recommend that you step up to it from G2. G3 has been extensively reworked with outstanding results. It's easier to use, and the planes fly more realistically. It's the perfect training aid for beginners, and it allows experts to practice new skills. Add that you can fly anywhere, anytime, and you might never make it to the flying field again!

See the Source Guide on page 152 for manufacturers' contact information.

"Every time I fly the plane, I'm impressed with its performance."

BY SCOTT HAMPTON > PHOTOS BY JOHN REID

MODELTECH SE-5A ARF



Quick-build WW I fighter

THE SE5a HAD A DISTINGUISHED CAREER DURING WW I, and it turned the tide of air supremacy for the British when it proved to be a deadly match for the German Albatros fighter. Now, ModelTech's .46-size ARF version continues that tradition of innovation and superiority. Not only does this plane look good in the air, but it's also one of the easiest and fastest ARFs I've ever assembled.

ModelTech's SE-5A features all-wood construction; an iron-on covering; a painted fiberglass cowl; wire wheels; adjustable, metal center-cabane struts; wooden outer struts; and a vacuum-formed gun. A 4-channel radio and .52 to .61 4-stroke are recommended.

SPECIFICATIONS

MODEL: SE-5A ARF
MANUFACTURER: ModelTech
DISTRIBUTOR: Global Hobby Distributors
TYPE: sport-scale biplane
LENGTH: 41 in.
WINGSPAN: 49.5 in.
WING AREA: 792 sq. in.
WEIGHT: 6.5 lb.
WING LOADING: 19 oz./sq. ft.
ENGINE REQ'D: .40 to .52 2-stroke or .52 to .61 4-stroke
RADIO REQ'D: 4-channel w/5 servos (rudder, elevator, throttle, 2 ailerons)
PRICE: $189.99

COMMENTS

This is one of the most enjoyable ARFs I have built. The instruction manual is very concise and well-written. It is a very stable-flying biplane.

HIGHLIGHTS

- Complete hardware package
- Wire wheels included
- Fiberglass cowl

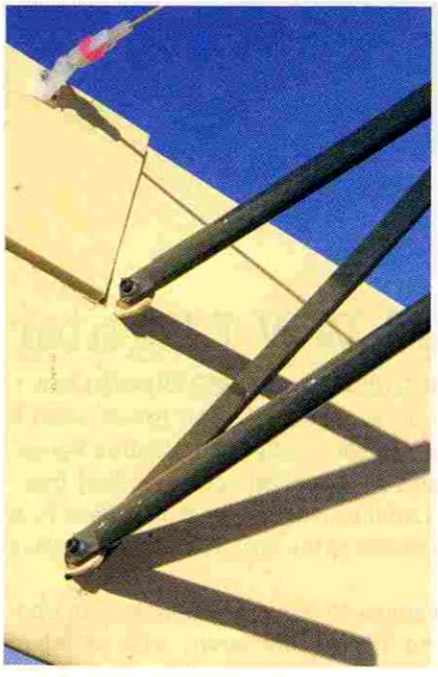
IN THE BOX

Inside the box, everything is wrapped in its own plastic bag—even the nuts and bolts. I sorted the bags by construction steps so I would have only a few loose parts on the bench during any step of the assembly. When I removed the fuselage from the bag, the first thing I noticed was that there weren't any wrinkles in the covering. Next, I checked the wings, and they, too, were wrinkle-free, as were all the other covered parts—not unusual, as the covering is Top Flite MonoKote. On inspecting the parts, I could tell right away that this is a high-quality kit that would be fun to build. The kit is so complete that the only things I needed to complete it were a Magnum .52 4-stroke, a radio, 5 servos, two 14-inch servo extensions, one 6-inch Y-harness, some fuel-line tubing, fuel and glue.

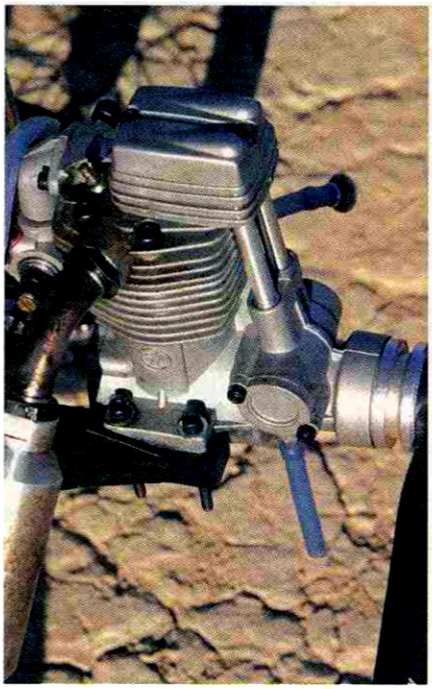
WING ASSEMBLY

With most of the kits I assemble, I like to start with the wings—mainly, attaching the ailerons. The slots are already cut, so all I had to do was insert the hinges, align everything and glue them into place with CA. Both wings are of one-piece construction, so no assembly was needed. Each wing has its own hardware bag, so it is easy to find the various nuts and bolts you need to attach them to the fuselage.

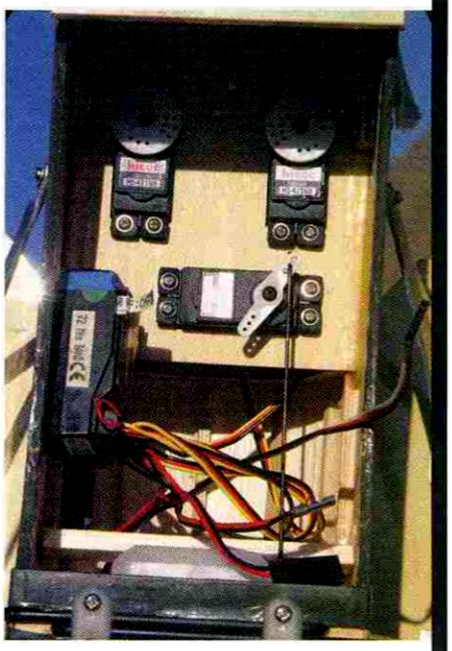
I test-fit the bottom wing onto the fuselage, but before attaching it, I made sure that the wingtips were equal distance to the



The N-struts are attached to the top and bottom wings with hex nuts and bolts. This secure attachment allows easy wing removal.



After the cowl has been removed, there is plenty of room to work on the Magnum .52 4-stroke.



The radio equipment is easy to access through the wing saddle. Ample room between the servos ensures that none of the servo wheels rubs against any other.

PHOTO BY JOHN DIBBS/THE PLANE PICTURE CO./PLANEPIX.COM

SE5a: ULTIMATE ACE MAKER

WHEN WW I BEGAN IN 1914, the airplane was barely 11 years old. It was nothing more than a plodding, noisy kite and was barely more dangerous than an observation balloon. As a weapon, it was difficult to take it seriously, but only four short years later, it had been transformed into a multidimensional weapon system of awesome potential. The Royal Aircraft Factory's SE5a is a classic case in point: it showed clearly that in time of war, man can quickly find efficient ways to rain death on his enemy.

The Scout Experimental 5 (SE5) was designed specifically to eliminate the awful shortcomings of aircraft such as the Sopwith Camel, and at the same time, give it an edge in combat over Germany's lethal Fokkers. The heart of the design for the SE5 was the Hispano Suiza liquid-cooled V-8. The 150hp engine was much easier for neophyte pilots to operate, and it didn't constantly try to twist the airplane into a pretzel the way the whirling rotary of the Camel did.

The less cantankerous engine was coupled with an airframe that replaced the fragile bones of the Camel with a robustness that would stand the new pilot in good stead in combat and in day-to-day operations. It was an extremely easy airplane to take off and land—something that absolutely could not be said about the Camel and its all-or-nothing kill-switch engine control. Moreover, when it was thrown around during a dogfight, it was working *with* the pilot; the Camel often fought its pilot and required him to compensate for its eccentricities. Although not as maneuverable as the Camel, the SE5 was much more flyable (read: less dangerous), and this meant that a pilot could concentrate on killing his enemy rather than being killed by his own airplane. Because of this, the Royal Air Force could take fledgling pilots and turn them into effective aerial warriors in much less time.

The original 150hp SE5 was relatively ineffective because of reliability problems and because only a limited number of those planes reached the front. By 1918, however, the 150hp Hispano Suiza had been replaced with the more powerful, geared 200hp Hispano and, later, the Wolseley Viper, which gave rise to the "a" in SE5a. With either engine, the airplane carried a synchronized Vickers, belt-fed .303-caliber machine gun that fired through the propeller and a drum-fed Lewis gun on the top wing in a sliding mount. The Lewis could be fired straight ahead over the prop or upward at an oblique angle. The ability to fire upward let the SE5a pilot shoot into the belly of an unsuspecting enemy or fire across the circle in a dogfight.

Fast (135mph), easy to fly and with a high rate of climb, the SE5a became an ace maker—witness Mick Mannock (73 kills) and Billy Bishop (72 kills). The fact that the SE5a was in combat for barely a year speaks volumes. In that short time, the airplane cut a swath through the enemy and in so doing, earned a place in history's fighter hall of fame.

—Budd Davisson

Visit Budd on the Web at airbum.com.

fuselage tail. My next step was to install all of the mounting plates and hardware necessary to bolt on the top and bottom wings. The instructions were very clear about where everything went. I used 2 Cirrus 26BB servos for the ailerons. Then all I had to do was to glue the mounting blocks on the tray and bolt down the servos. In this kit, you won't find the usual string that pulls the servo extensions through the wing. ModelTech installed paper tubes in the wing for you to guide the servo wires through. I found this to be a much easier way to accomplish this task. I used two 14-inch servo-wire extensions and one 6-inch Y-harness to connect the servos to the receiver.

FUSELAGE ASSEMBLY

The first step in the fuselage's construction is to install the tail section. I inserted the vertical stabilizer into precut slots in the horizontal stabilizer and temporarily aligned it. I made marks to show where I needed to cut the covering material from both the horizontal and vertical stabilizers. I used 30-minute epoxy to attach the stabilizer and fin together; before the epoxy cured, I used a square to align everything. After the epoxy had cured, I pinned the tail section to the fuselage. I measured from the wingtip to the tip of the

stabilizer to make sure that the tail was aligned with the wing. After some minor adjustments, I epoxied the tail section to the fuselage using 30-minute epoxy. I hinged all the control surfaces to the tail section and installed the HS-422 servos into the servo tray before I epoxied it into the fuselage. I assembled the fuel tank and installed it into the front of the fuselage with foam packed around it to insulate it from vibration. The last thing I did was to attach the engine mount to the firewall. This was simple to do because the mounting holes had already been drilled into the mount, and the blind nuts were preinstalled.

FINAL ASSEMBLY

I installed the pushrods on the servos for the tail section and connected the pushrods to the rudder and elevator using the supplied clevises. I then put the battery under the fuel tank and secured it in place with foam. I used the Magnum .52 4-stroke for power. The engine is positioned on the mount so that the prop washer is 4¾ inches from the firewall. I marked the locations of the holes needed for the bolts and locknuts and drilled them into the firewall. After the engine had been mounted, I slid the throttle pushrod into the preinstalled pushrod sleeve and connected the throttle servo.

Before I installed the fiberglass cowl, I used thick paper to make a template and marked the exhaust, needle valve and glow-plug cutouts on it. With the cowl in place, I transferred the locations of all the holes and then cut them out of the cowl. I slid the cowl over the engine and attached it to the front of the fuselage.

Now that everything was installed and hooked up inside the fuselage, I remounted the wings. I mounted the bottom wing first and then added the N-struts and the top wing. Because this is a biplane, it's important to check each wing's angle of incidence. The bottom wing should have 0 degree of incidence, and the top wing should have 1 degree of incidence. After I checked the center of gravity in my SE-5A, it was ready to go.

CONCLUSION

The SE-5A has the scale looks of a formidable WW I aircraft and the docile flight characteristics of a stable, advanced trainer. If you're looking for something that's easy to assemble and has solid flight performance, you've found your plane. Add the scale looks of a plane that turned the tide of war, and how can you go wrong?

See the Source Guide on page 118 for manufacturers' contact information.

GEAR USED

RADIO: Hitec Eclipse7 transmitter; 3 Hitec HS-422 deluxe servos and 2 Cirrus 26 BB miniservos; Hitec RCD 3800 receiver

ENGINE: Magnum .52 4-stroke

FUEL: Wildcat 15%

PROP: Zinger 11x7 (wood)

IN THE AIR

IN THE AIR

For the SE-5A, I used a Magnum .52 4-stroke with a stock muffler, a Zinger 11x7 wooden prop and 15% Wildcat fuel. This combination provides plenty of power to pull the 5.5-pound plane around the sky with some authority.

CONTROL THROWS

Elevator: ±½ in. (low); ±¾ in. (high)
Elevator: ±¼ in. (low); ±⅝ in. (high)
Rudder: ±½ in. (low); ±⅞ in. (high)

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** this plane handles very well even at slow speeds. That really is a nice feature when you are on final approach for landing.
- **Tracking:** the SE-5A tracks quite well on the ground even though there is no tailwheel (just a skid). In the air, the plane flies straight and true; it locks on to the direction in which you point it.
- **Aerobatics:** this scale WW I biplane will do all the scale maneuvers that the full-size one did. The model flies through each maneuver with smoothness and authority.
- **Glide performance:** if you set the wing incidence and balance the plane correctly, it will glide very well under little power. With no power, just keep a nose-down attitude.
- **Stalls:** when the plane climbs at 45 degrees and the power is cut to an idle, it will stall, drop a wing slightly and then drop its nose down; after a short buildup of speed, it recovers very quickly.

PILOT DEBRIEFING

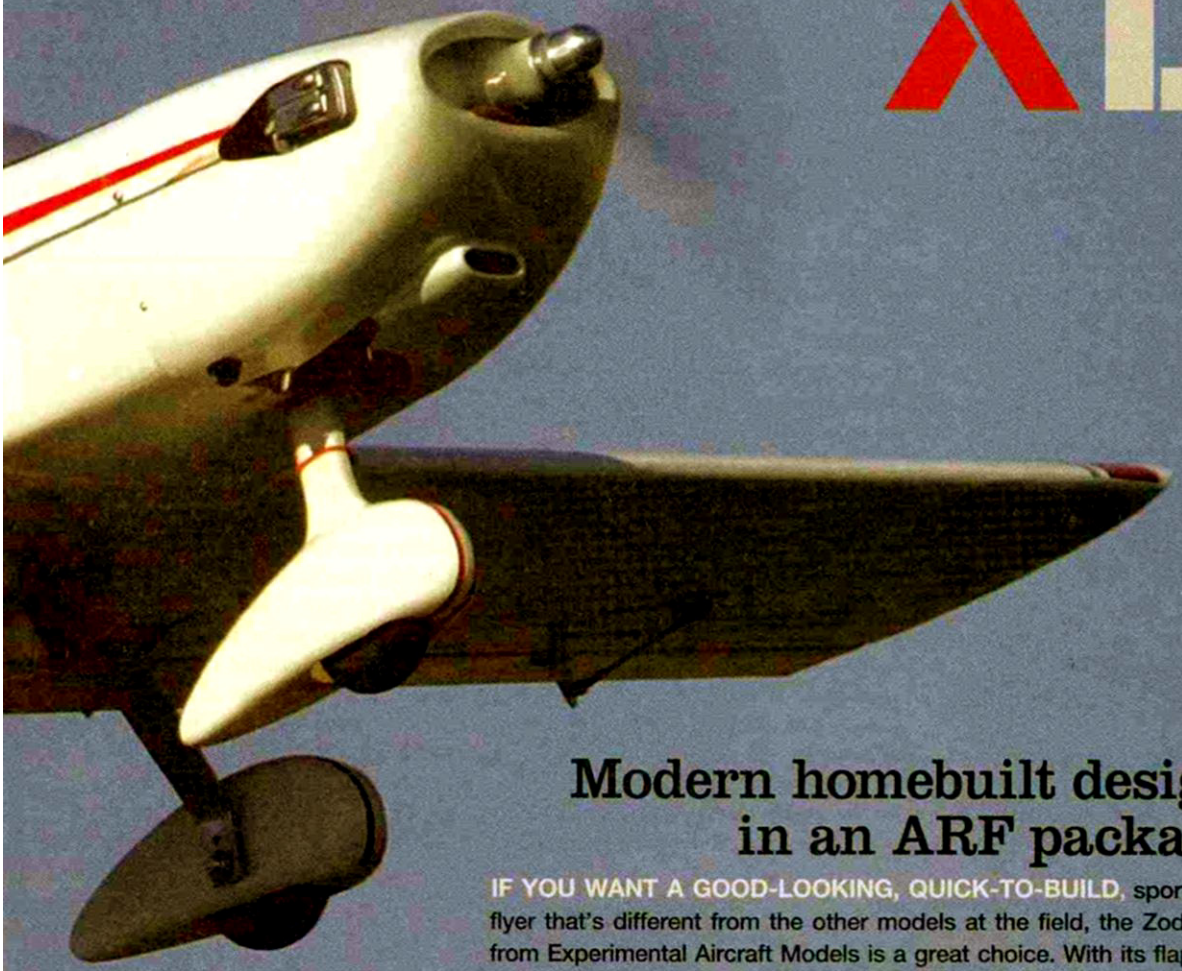
Every time I fly the plane, I'm impressed with its performance; this is a good-flying aircraft. The Magnum .52 4-stroke is the perfect mill for this plane. On the ground, it uses up only about 20 feet of the runway with little rudder correction before it leaps into the air. Once in the air, I can fly it at ½ throttle. At full throttle, it flies a little faster than scale speed, but it has plenty of power to do the scale maneuvers such as split-S's, loops, rolls and combinations of these. When I came in for my first landing, I was surprised because when I cut the throttle down to about ¼, the plane still had too much power to land. On my next approach, I reduced the throttle to a little above idle, and the SE-5A just floated down. When the plane got close to the ground, I flared a little, and it sat down for a nice 3-point landing. On the rollout, I used the rudder to control the tracking and found it to be quite effective.

"The Zodiac XL can be built with either a tricycle landing gear or in a tail-dragger arrangement."

BY GEORGE LEU > PHOTOS BY GERRY YARRISH & DERON NEBLETT

EXPERIMENTAL AIRCRAFT MODELS

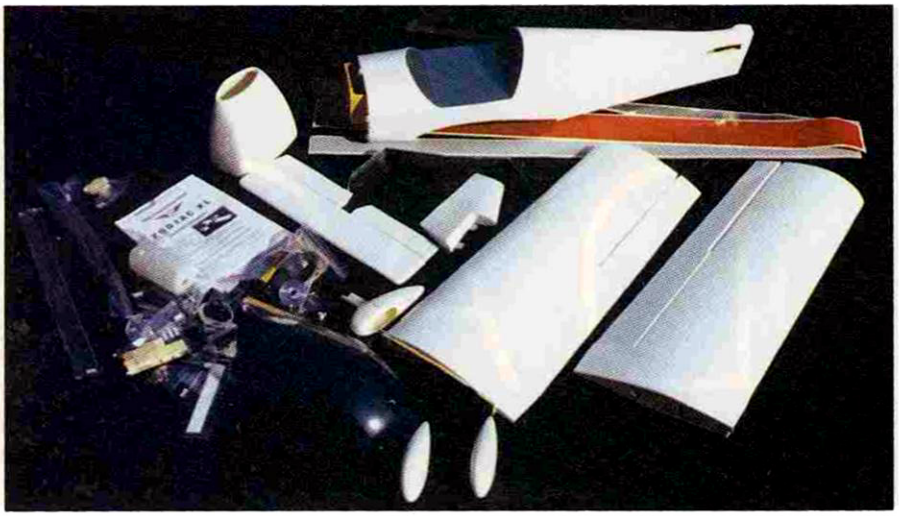
ZODIAC XL



Modern homebuilt design in an ARF package

IF YOU WANT A GOOD-LOOKING, QUICK-TO-BUILD, sport-scale flyer that's different from the other models at the field, the Zodiac XL from Experimental Aircraft Models is a great choice. With its flaps and pants-covered tricycle landing gear, the Zodiac has all the basic equipment to be a good, fun-scale competition model as well. All you have to do is find some documentation pictures, and you'll be ready to go.

The full-size Zodiac XL is an Experimental Aircraft Association (EAA) homebuilt aircraft. It is a kit plane that is assembled by the owner/builder, who has to accomplish at least 51 percent of the construction for the aircraft to fall into the experimental-aircraft category. Experimental Aircraft Models produces many scale kits of EAA homebuilt aircraft, including the Challenger II, RV-6, Glastar and Glasair, Europa XS and Velocity XL. The 1/5-scale Zodiac XL is typical of the company's lineup: very distinctive-looking and fun to fly.



SPECIFICATIONS

MODEL: Zodiac XL
MANUFACTURER: Experimental Aircraft Models
TYPE: 1/5 scale sport flyer
WINGSPAN: 60.5 in.
WING AREA: 683 sq. in.
WEIGHT: 6.5 lb. ready for flight
WING LOADING: 22 oz./sq. ft.
LENGTH: 47 in.
ENGINE REQ'D: .35 to .58 2-cycle or .45 to .60 4-cycle
RADIO REQ'D: 5-channel w/7 servos

COMMENTS

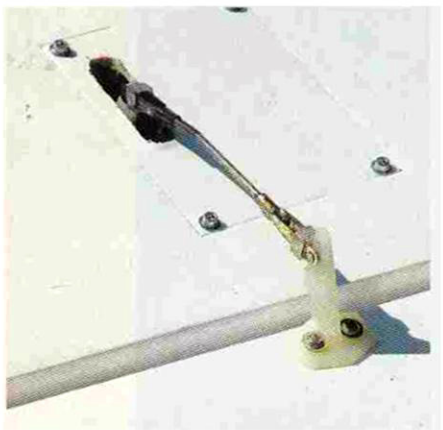
The Zodiac is an unusual sport-scale model that flies well. It's relatively short-coupled and has scale control-surface sizes and placement—all good things for scale competition. Just be sure to keep the control throws at their minimum settings until you get used to the way the model responds.

HIGHLIGHTS

- Lightweight construction
- High-quality brand-name hardware
- Excellent assembly manual
- Good control response

THE KIT

When I opened the box, I was amazed at all the hardware included in the numbered plastic bags: just about anything needed to assemble the model was there. The wings are balsa-planked over EPS foam-cores and have built-up balsa aileron and flap construction. The fuselage is also balsa-planked over lite-ply formers and a foam turtle deck. The canopy is vacuum-formed butyrate, and the landing gear is formed out of aluminum. The fiberglass wheel pants have a white gelcoat finish.



Each of the aileron and flap servos is installed under flush-fitting wing hatches for a neat, easy-to-adjust setup.

Also included are a polished-aluminum spinner, wheels, machine-cut plywood servo mounts, a fuel tank and fuel lines, bell-cranks, horns, pushrods and clevises and engine mounts. Many brand-name items from Du-Bro and Sullivan are used. The model comes covered with Oracover film, and the covering job is first rate. All the control surfaces are hinged with CA hinges installed. When I test-fit the parts, they all went together nicely.

ASSEMBLY

A comprehensive, very user-friendly building manual is included, and its numerous photos make assembly steps very easy to follow. Begin by attaching all the control surfaces, joining the wing halves and then mounting the wing to the fuselage. Next, bolt the main landing gear into place. The Zodiac XL can be built with either a tricycle landing gear or in a tail-dragger arrangement. I decided to use the tricycle-gear setup for easier ground handling—very important at scale contests!

Another neat, scale feature is the all-flying rudder. It looks cool and provides excellent yaw authority.

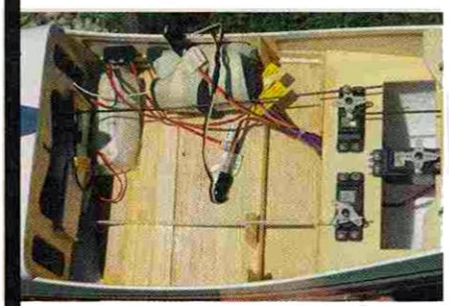
The nose-gear installation is simple, and I used the included hard-wire pushrod and linkage to attach the nose gear to the rudder servo. To minimize steering play, I recommend that you install a plywood guide bracket near the pushrod's center to prevent the wire from bowing under load. The rudder and elevator use standard hardwood-dowel pushrod assemblies.

For power, I installed an O.S. .70 4-stroke engine. Whichever type of engine you decide to use, the distance from the firewall to the engine's thrust washer should be 4 7/8 inches. Since the firewall has 2 degrees of right thrust built in, be sure to move the engine's vertical centerline about 3/16 inch to

The O.S. .70 4-stroke engine fits nicely and provides plenty of power for the Zodiac.

Standard hardware is used throughout. The rudder and elevator control horns and pushrods are shown.

The big bubble canopy demands some cockpit detailing. The D&R Laserworks instrument panel fits almost perfectly into place.



How much more room could you ask for in the radio compartment? The fuel tank and battery pack are installed in front of the forward bulkhead.

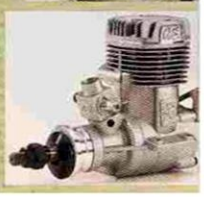
GEAR USED

RADIO: Airtronics RD6000 transmitter with 92765 receiver, 7 Airtronics 94102 servos

ENGINE: O.S. .70 4-stroke

FUEL: Wildcat 30% nitro (Heli blend)

PROP: Top Flite 13x6



the left. This will keep the prop shaft centered at the front of the cowl. After the engine had been set up, I attached the tail surfaces and then installed the rudder and elevator servos and the control linkage. I installed an Airtronics RD6000 radio system and standard 94102 Airtronics servos. I placed the battery pack next to the fuel tank, installed the radio switch in the fuselage side just below the canopy and then installed the wheel pants.

The last thing to do is install the large bubble canopy. I cut it to shape at the molded-in guide lines but found that the canopy only fit flush to the cockpit-cutout area. To give the canopy something to rest against, I added a ¼-inch-high piece of hardwood along each cockpit side to brace it. I then painted on the canopy frames and screwed the canopy into place with small sheet-metal screws.

That big canopy called for some interior details. I installed a Hangar 9 pilot bust, a balsa backrest and a D&R Laserworks instrument panel, and last, I affixed the included, precut stick-on trim graphics.

CONCLUSION

The Zodiac XL flies great, and I love that it fits nicely—fully assembled—into the back of my small car. If you want something out of the ordinary, the Zodiac could be what you've been looking for. I highly recommend it! +

See the Source Guide on page 152 for manufacturers' contact information.

IN THE AIR

IN THE AIR

The Zodiac XL is a fun airplane to fly. Powered with an O.S. .70 4-stroke, there's more than enough power for all kinds of performance including some non-scale aerobatics. Any 2-stroke .32 to .40 engine would be ideal power for this model.

CONTROL THROWS

Rudder low and high rate ½ in. (measured at the top of the rudder); expo 30%

Elevator: ±⅝ in. (low); ¾ in. (high); expo 30%

Ailerons: ±½ in. (low); ⅝ in. (high); expo 30%

Flaps: ⅞ in. (fully extended)

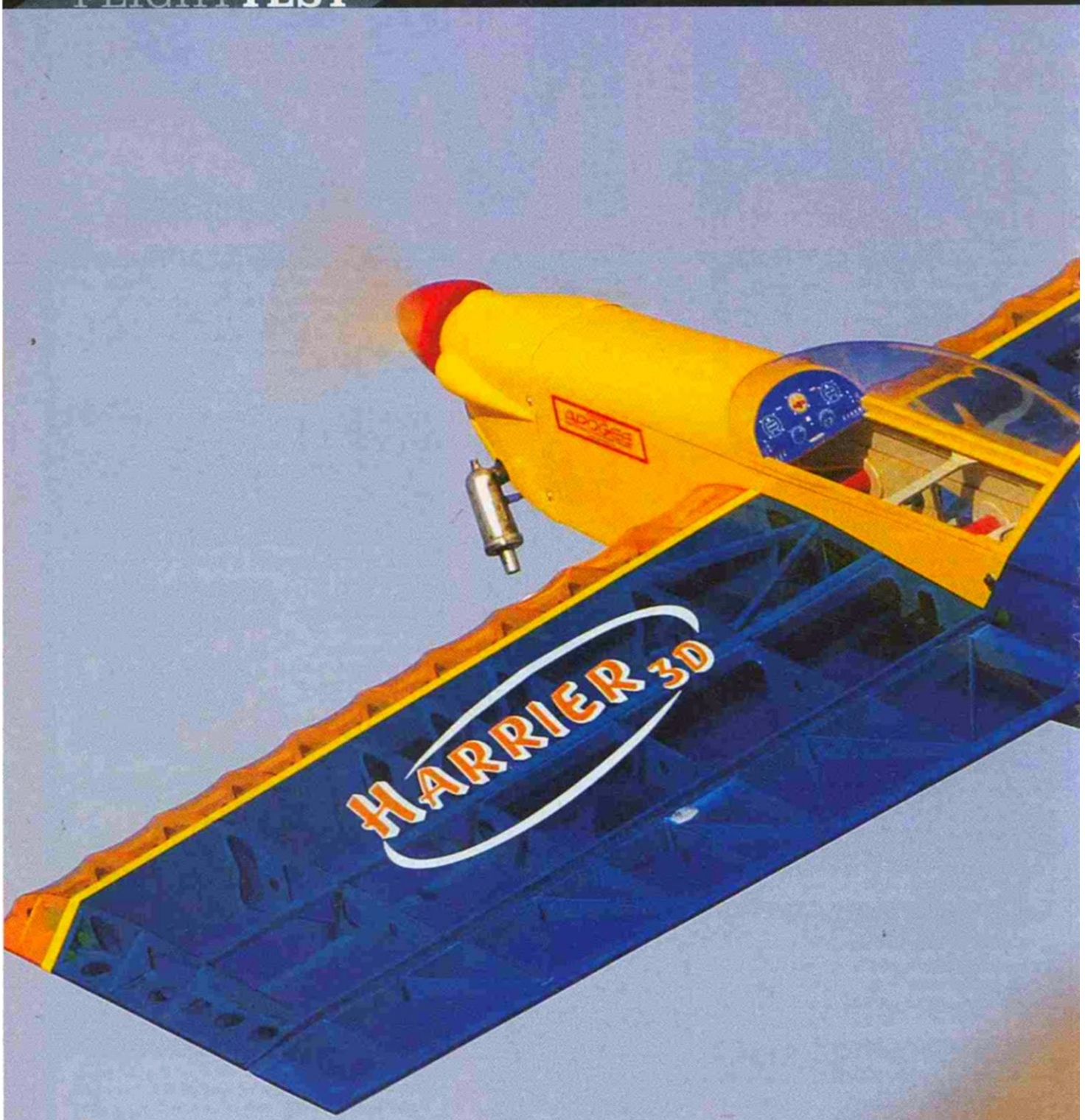
Balance point: 3⅛ in. aft of the wing's leading edge

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** the Zodiac's true-to-scale size, placement of the control surfaces and relatively short coupling make it a fairly responsive model that's very close to being neutrally stable.
- **Tracking:** with rates and control throws at the minimums, the model is easy to keep on track. At high rates and throws, however, you could over-control the model.
- **Aerobatics:** with the CG moved back a little and with increased control-surface throws, the model can easily do snap rolls and other aerobatics.
- **Glide performance:** the model has a brisk descent rate with power pulled back because of its fairly wide fuselage. Control remains responsive.
- **Stalls:** a properly placed CG and limited control throws give the model good slow-speed characteristics. The stall break is positive, but recovery is clean.

PILOT DEBRIEFING

With its full-flying rudder setup, the model has sufficient rudder area beneath the stabilizer for surprisingly good yaw control. On the ground, the model has a nose-down attitude, so it doesn't come off the runway until you give it a good pull on the elevator stick. I found a long, flat landing approach to be more controllable than a short, steep one. The flaps are effective, but the model really doesn't need them, even while landing on a short runway.



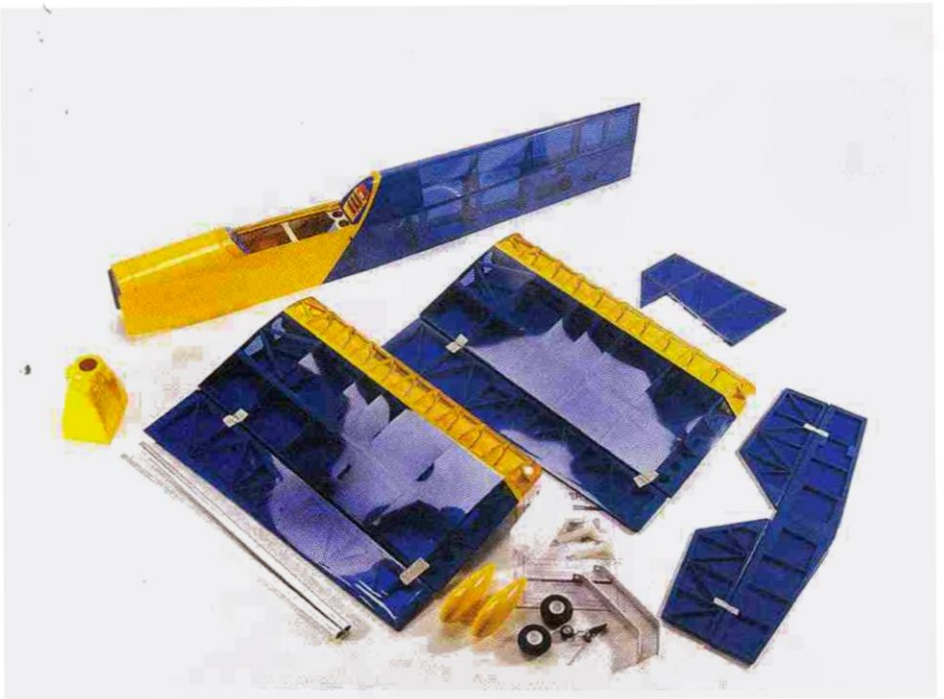
SEAGULL MODEL HARRIER

BY DAVE HARRIS > PHOTOS BY JOHN REID

3D

A pilot's dream machine

LOOKING FOR GIANT-SCALE PERFORMANCE ON A .90 budget? You've found the right plane: with its ultralight airframe and oversize control surfaces, the Seagull Models Harrier 3D is a pilot's dream machine. From precision aerobatics to extreme 3D maneuvers, this plane gets it done and is a real blast to fly.



SPECIFICATIONS

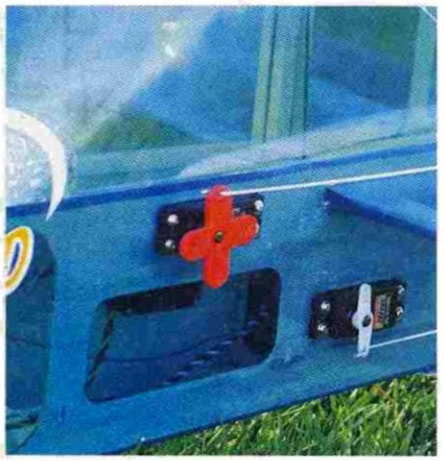
MODEL: Harrier 3D
MANUFACTURER: Seagull Model
DISTRIBUTOR: Horizon Hobby Distributors
TYPE: 3D aerobatic ARF
AIRFOIL: symmetrical
WINGSPAN: 60.5 in.
WING AREA: 948.38 sq. in.
WEIGHT: 7.5 lb.
WING LOADING: 18.2 oz./sq. ft.
LENGTH: 66 in.
ENGINE REQ'D: .60 to 1.00 2-stroke or .90 to 1.20 4-stroke
RADIO REQ'D: 4-channel w/6 servos (2 aileron, 2 elevator, rudder, throttle)
PRICE: $175

COMMENTS

The Harrier 3D is well suited to intermediate and advanced pilots because of its amazing maneuverability and inherent stability.

HIGHLIGHTS

- High-quality construction and parts
- Fast, easy assembly
- Spectacular performance



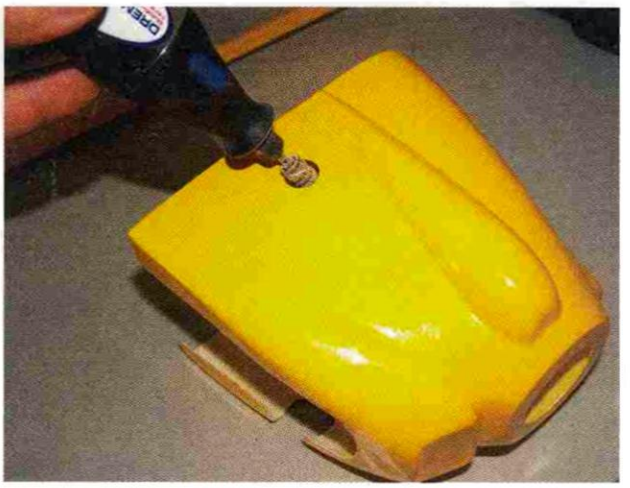
The elevator/rudder servos are externally mounted for ease of installation and adjustment. The transparent covering makes it simple to guide the servo wires through the fuselage.

The Harrier 3D comes built up and covered in transparent yellow and blue UltraCote. Its two-piece symmetrical wing is easy to remove and features two aluminum rods for stability. The ailerons, elevator and rudder are slotted to accept CA hinges. A fiberglass cowl and wheel pants, all the necessary hardware, heavy-duty aluminum landing gear, a canopy and self-adhesive decals complete the package.

ASSEMBLY

The Harrier requires very little assembly to get it into the air. The major steps include mounting the engine and fuel tank and aligning and attaching the tail feathers. I finished it during four leisurely evenings. The Harrier 3D requires a large work surface because of its size. The instructions keep you well informed and are easy to read.

I started assembly by hinging all of the control surfaces. This was quick and easy to do because all of the CA hinge slots are already cut. I just aligned the surfaces and added a little thin CA. After completing this step, I decided to test-fit the wing to the fuselage. The wing halves are joined with a pair of aluminum dowels, and the wing is attached to the fuselage with four plastic retaining bolts. When the wing was fully in



A cordless rotary tool equipped with a small sanding drum (such as the one shown above) makes light work of cutting out fiberglass engine cowls.

Don't be misled by the Saito 100's elegant polished valve cover and pushrod tubes; inside it is a fire that takes the Harrier 3D to new heights with power to spare.

E-POWER CONVERSION

SINCE THE HARRIER 3D WEIGHS in at approximately 7.5 pounds and has plenty of room for batteries, I thought it was a perfect candidate for a brushless motor with Li-poly batteries. I decided to use a Mega 22-30-2 motor with a Model Electronics Corp. Superbox 5:1 gearbox. The batteries are Apogee 6s2p 4960mAh Li-poly custom-built packs. Because I use this high-voltage Li-poly pack and want even more reliability, I also use an Ultimate BEC from Cool Flight Systems as a voltage regulator and an Apogee 3s 830mAh Li-poly pack as a power source for the 5 Hitec servos and Supreme 7 receiver.

The electric Harrier 3D flies better than ever and has as much—if not more!—power and response than its nitro counterpart. The plane is now 9 ounces lighter and floats like a glider. Hovers and torque rolls are accomplished at only ½ throttle, and at ¾ throttle, you had better hold on to your hat, because this baby moves air.

On the bench, I use an AstroFlight Wattmeter for testing. At full throttle, the power system produced 1,080 watts at 62 amps, but it's important to keep in mind that the 6s2p Apogee batteries deliver 52 amps continuous and 70A bursts for up to 15 seconds, so throttle management is a key factor.

position, I removed it and proceeded to the elevator/rudder installation. The installation of the elevator is well planned; there are top and bottom guide wires for support and turnbuckles to adjust tension.

A .61 to 1.00 2-stroke or a .91 to 1.20 4-stroke is recommended for the Harrier 3D. I chose to use a Saito 1.00 Golden Knight 4-stroke. This attractive setup provides plenty of power and is very reliable.

The heavy-duty landing gear is attached to the fuselage with four bolts and preinstalled blind nuts. The hardest part was applying the long, thin decals. To make this easier, I sprayed soapy water onto the wing and body, positioned the decals and carefully rubbed them into place.

RADIO INSTALLATION

The Harrier 3D has plenty of room for radio gear, and the component locations are well thought out. I started by installing the six servos in the predetermined locations. You'll need to add 1-foot-long extensions to the rudder, elevator and aileron servos. I mounted the receiver and battery pack side by side at the rear of the cockpit with Velcro®. I used an Apogee 3-cell, 830mAh Li-poly receiver pack that has a Kool Flight Systems Ultimate BEC voltage regulator. This option saves weight and delivers a continuous 6 volts to the servos. The battery voltage is 11.1, so this setup is comparable to a 1500mAh Ni-Cd pack at only quarter the weight.

> "... they produced a plane that really does blur the line between hardcore 3D PERFORMANCE AND PRECISION STABILITY."

SUMMARY

The Seagull Models Harrier 3D is one of the finest planes I have ever had the pleasure to work with. Right out of the box, the ultralight airframe and large flying surfaces made the Harrier 3D capable of any maneuver I could think of. It is the plane that will set a new standard for 3D performance. ✈

See the Source Guide on page 152 for manufacturers' contact information.

GEAR USED

RADIO: Hitec Eclipse 7 w/Supreme 7 receiver, HS 525BB and HS 425BB servos

ENGINE: Saito 100 Golden Knight

FUEL: Power Master 15%

IN THE AIR

The Saito 1.00 4-stroke engine spinning an APC 15x5 prop pulls the Harrier swiftly into the air and provides unlimited vertical climbout.

CONTROL THROWS

Elevator: ±2¾ in. (high); ±9/16 in. (low); 70% expo

Aileron: ±2½ in. (high); ±⅝ in. (low); 50% expo

Rudder: ±2½ in. (high); ±1¾ in. (low); 50% expo

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** at partial throttle, this plane flies hands-off.
- **Tracking:** the controls are accurate and positive. This plane does exactly what I tell it, when I tell it.
- **Aerobatics:** this is where the Harrier 3D really shines. I like to start my show with a tight snap and then transition into an elevator; from there, a smooth rolling circle is a nice crowd-pleaser.
- **Glide performance:** the Harrier 3D glides so well that on a dead-stick landing, I had to tip the nose down to avoid overshooting the runway.
- **Stalls:** this plane falls slowly, and it's level and stable without any sign of wing rocking or potential snaps.

PILOT DEBRIEFING

The Harrier 3D can take off from a smooth surface in as little as 15 to 20 feet.

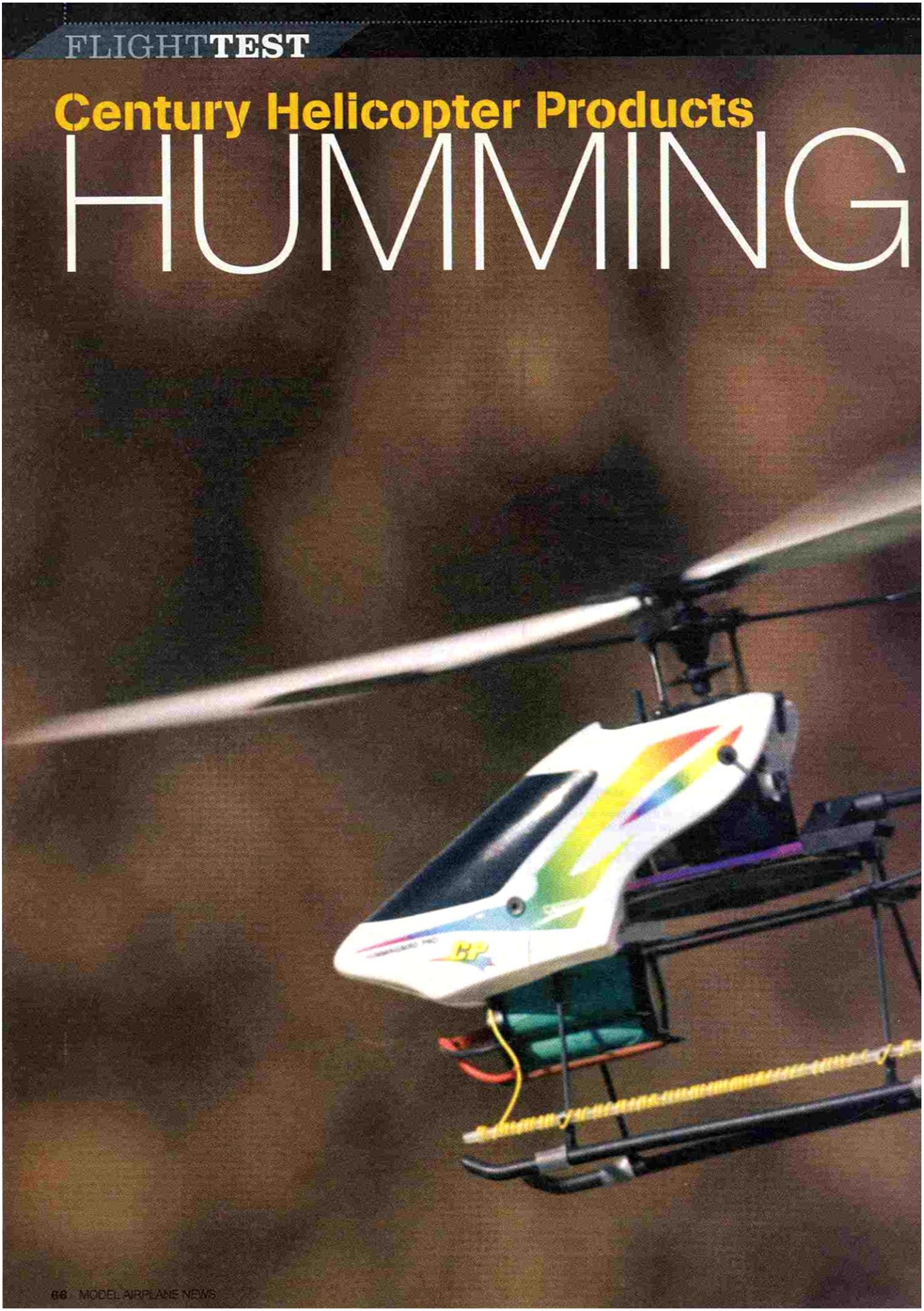
Low-speed performance is really what it's all about; it's great for elevators, harrier rolls and low-speed, knife-edge flight. At high speeds, it performs like a pattern ship. Turns are precise, and rolls are perfectly axial. At higher speeds, I recommend that you use dual rates or expo on all surfaces because the large surfaces are so effective. With expo turned on, I didn't notice any instability at high speeds, and the transition from low- to high-speed flight was seamless.

The Harrier 3D is an absolute pleasure to fly. It really shines at 3D aerobatics. If you can name it, the Harrier can do it. Hovering, torque rolls, harriers, loops, snaps and knife-edge; it will do them all. Knife-edge flight requires minimum rudder input.

Landings are very smooth and soft and easier than expected. I suspect that the soft landing is due to the fat, symmetrical wing that slows the Harrier to a stable crawl and to the large foam tires combined with flexible landing gear that cushion landings. On the ground, the steerable tailwheel has the authority to point the plane in the direction you choose.

Century Helicopter Products

HUMMING



BY DON EDBERG > PHOTOS BY DON EDBERG & JOHN REID

BIRD CP

This bird really sings

ELECTRIC, MICRO-SIZE HELICOPTERS HAVE REALLY TAKEN THE HELI WORLD BY STORM— and why not? They're inexpensive and easy to assemble, and their performance is now on a par with larger, .30-size glow-powered heli models. Add to this their fly-anywhere, anytime convenience, and you have the stuff that modeling dreams are made of. Enter the Century Helicopter Products micro-size Hummingbird CP (collective pitch) heli. At first glance, it appears to be basically the same as the fixed-pitch version of the Hummingbird, but in fact, the two have very little in common. The Hummingbird CP uses CCPM (cyclic collective-pitch mixing) for control and requires 3 microservos to control the swashplate.

CENTURY HELICOPTER PRODUCTS HUMMINGBIRD CP

SPECIFICATIONS

MODEL: Hummingbird CP
MANUFACTURER: Century Helicopter Products
TYPE: electric micro-helicopter
MAIN ROTOR DIAMETER: 20.5 in.
LENGTH: 19.1 in.
WEIGHT: 11.5 oz.
RADIO REQ'D: 5-channel heli w/CCPM
FLIGHT DURATION: 5 to 8 min.
PRICES: $99.95 (heli & gyro) to $400 (complete w/everything needed)

COMMENTS

The Century Hummingbird is a great micro heli for novice pilots just starting out or for experts looking for a capable aerobatic indoor heli. The heli is conveniently available as a complete package with high-quality components.

HIGHLIGHTS

- Fast assembly
- Good-looking
- Flies great

This attractive heli comes in different versions, from the heli kit only to several combo packages that include everything you need to get airborne. The package I reviewed arrived as a complete setup, including an Airtronics RD6000 Super transmitter and a Century receiver and servos. This setup truly is "almost ready to fly," so let's take a closer look.

FIRST IMPRESSIONS

The Hummingbird CP has a beautiful violet anodized-aluminum chassis plate that doubles as a heat sink for the main-rotor drive motor. Most of the other airframe components are made of plastic or carbon fiber. The main rotor blades feature a cambered airfoil with plastic covering and are made of wood with lightening cutouts visible beneath the covering.

The heli is powered by a 7-cell, 600mAh NiMH battery pack that Century calls the "Bird Seed," and it is plugged into a unique mixer control board that distributes power to three systems: the receiver to power the RC system, the speed control for the main rotor and the tail rotor for yaw or directional control.

The tail rotor is directly driven by a small electric motor mounted on the end of the tail boom. This means that the only connections needed for the tail rotor to work are the motor wires that are connected to the mixing board. This results in a very clean, efficient and lightweight tail-rotor system, since there aren't any driveshafts or belts to hassle with.

The heli requires at least a 5-channel programmable heli radio with 120-degree CCPM programming. It cannot be flown using a simple 4-channel or even a 6-channel system, unless the 3-servo CCPM feature is present. Keep this in mind if you don't have such a radio system.

ASSEMBLY NOTES

It's best to begin assembly after the transmitter and airborne batteries have been fully charged. The Hummingbird comes with a wall charger that will charge the Bird Seed battery in about 90 minutes. It is not an automatic charger, so you must remember to unplug the battery before it is over-charged. Instead, you may wish to use your favorite fast-charger, as long as it's suitable for NiMH batteries. The Airtronics transmitter is charged using the supplied overnight charger.

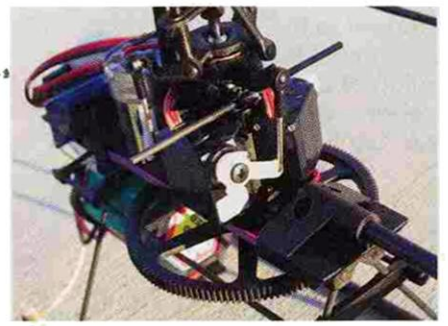
According to its colorful cardboard box, the Hummingbird CP is a 95-percent RTF electric-powered helicopter. This description is definitely true. It took me only about an hour to get it ready to fly, and I build very slowly!

Assembly begins by simply removing the chopper from its box. The flybar must be centered, since it's shipped off-center to fit into a more compact container. Once it was centered, I tightened it with the supplied hex wrench. You also have to make sure that the paddles are both set at the correct angle. Loosen the screws that secure the paddles and adjust their angle, if necessary; mine didn't need any adjustment.

Next, the servos are mounted on the

The Hummingbird uses 120-degree CCPM and requires 3 servos to actuate the rotor head. They're installed directly on the chassis.

A small motor directly drives the tail rotor. It's a simple arrangement that eliminates the need for a complex tail-rotor drive system.



Given the small size of the heli, everything fits nicely.

The Bird Seed battery pack sits beneath the heli and can be slid fore and aft to adjust the CG.

frame. I first turned on the RC system and centered the servos, repositioning the arms as necessary. I also enlarged the holes in the servo arms to match the pushrod diameter. I mounted the servos using the supplied double-sided foam tape and connected the pushrods to the servo arms. The pushrods are prebent and already connected to the swashplate. Last, I adjusted the pushrods until the swashplate was horizontal when the transmitter's cyclic stick is at neutral. My only problem was that I plugged the servos into the wrong receiver ports, so the swashplate didn't work correctly until I connected the servos into the proper ports.

I found the Airtronics RD6000 radio very easy to work with. A special, custom, four-page addendum instruction manual made it possible to program the radio in just two or three minutes—and I am not kidding!

Mount the mixer control board, micro-gyro and receiver on the heli's frame. You should also secure these components with double-sided foam tape. The biggest assembly challenge is that you must arrange all of the wires and components carefully so that the plastic canopy will fit properly. I recommend that you not install the canopy until you've adjusted the gyro gain, as it's impossible to adjust the gyro with the canopy installed. I had a slight problem when I attached the canopy; it has four rubber grommets that slide onto rods attached to the frame, and these grommets tended to come loose. A tiny drop of CA between the canopy and the grommets easily solved this. To reduce ground vibrations just before takeoff, I placed four short pieces of silicone fuel tubing near the ends of the landing skids. A quick check of the center of gravity, and the Hummingbird was ready to go!

GEAR USED

RADIO: Airtronics RD6000 transmitter; Century 6-channel receiver; 3 Century microservos

MOTOR: brushed 370 (included)

BATTERY: 9.6V NiMH

FINAL THOUGHTS

The Century Helicopter Products Hummingbird CP is a very well-engineered, truly ARF micro-heli that is fun to fly. This cute little helicopter is very easy to trim, and it will fly just about anywhere you like. The cyclic and collective response is very solid and predictable and equals that of many glow-powered helicopters I have flown! If you're looking for a micro-heli that can be flown indoors and out, the Hummingbird CP is hard to beat.

See the Source Guide on page 152 for manufacturers' contact information.

IN THE AIR

IN THE AIR

As delivered, the kit includes a premounted 370 electric motor, a Hummingbird mixer board, main- and tail-rotor speed control and the Bird Seed 7-cell, 600mAh NiMH battery pack.

CONTROL THROWS

Swashplate left/right (roll): ±25 degrees **servo throw;** expo: 35%

Swashplate up/down (elevator): ±25 **degrees servo throw;** expo: 35%

Collective pitch: 5.5mm swashplate movement from minimum to maximum

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** the Hummingbird is very easy to trim and fly, and it flies just about anywhere. It can be susceptible to wind gusts outdoors because of its light weight.
- **Control response:** the heli is very responsive and easy to fly, even in the smallest of areas. You can have a blast hovering it in your living room (if your spouse will let you!).
- **Tracking:** the Hummingbird comes with a tiny gyro that keeps it very stable in all maneuvers and in a hover.
- **Aerobatics:** in the hands of a competent pilot, the Hummingbird can perform all the standard aerobatic maneuvers—indoors and quietly!
- **Glide performance:** an autorotation main gear is available as an option but wasn't tested on the review model.

PILOT DEBRIEFING

The Century Hummingbird CP is a 95-percent-RTF electric-powered micro-helicopter that took me less than an hour to complete and fly. The version I tested included an Airtronics RD6000 Super transmitter along with a Century 5-channel lightweight receiver, a tiny gyro and 3 Century CN2033 microservos.

The model features an anodized-aluminum chassis plate/motor heat sink; other airframe components are made of plastic or carbon fiber. The main rotor blades are wood with plastic covering. Model setup is rapid with the provided RD-1000 instruction sheet. Note that the Hummingbird CP requires a 5-channel programmable radio with 120-degree CCPM. This model should be flown outdoors only when it's calm or when winds are very light. The tail rotor is very close to the ground and can become tangled in the grass, so do your takeoffs and landings in a cleared area. Battery power makes flying simple, and in relatively fast forward flight, the Hummingbird showed very predictable and good characteristics. I typically got 5 to 6 minutes of flying time on a charge (you'll get more if you use a Li-poly battery). For those who are interested in more power for aerobatics, a brushless motor can also be used. An optional autorotation gear is also available, as are symmetrical blades (the stock blades are cambered). This is a great micro-heli!

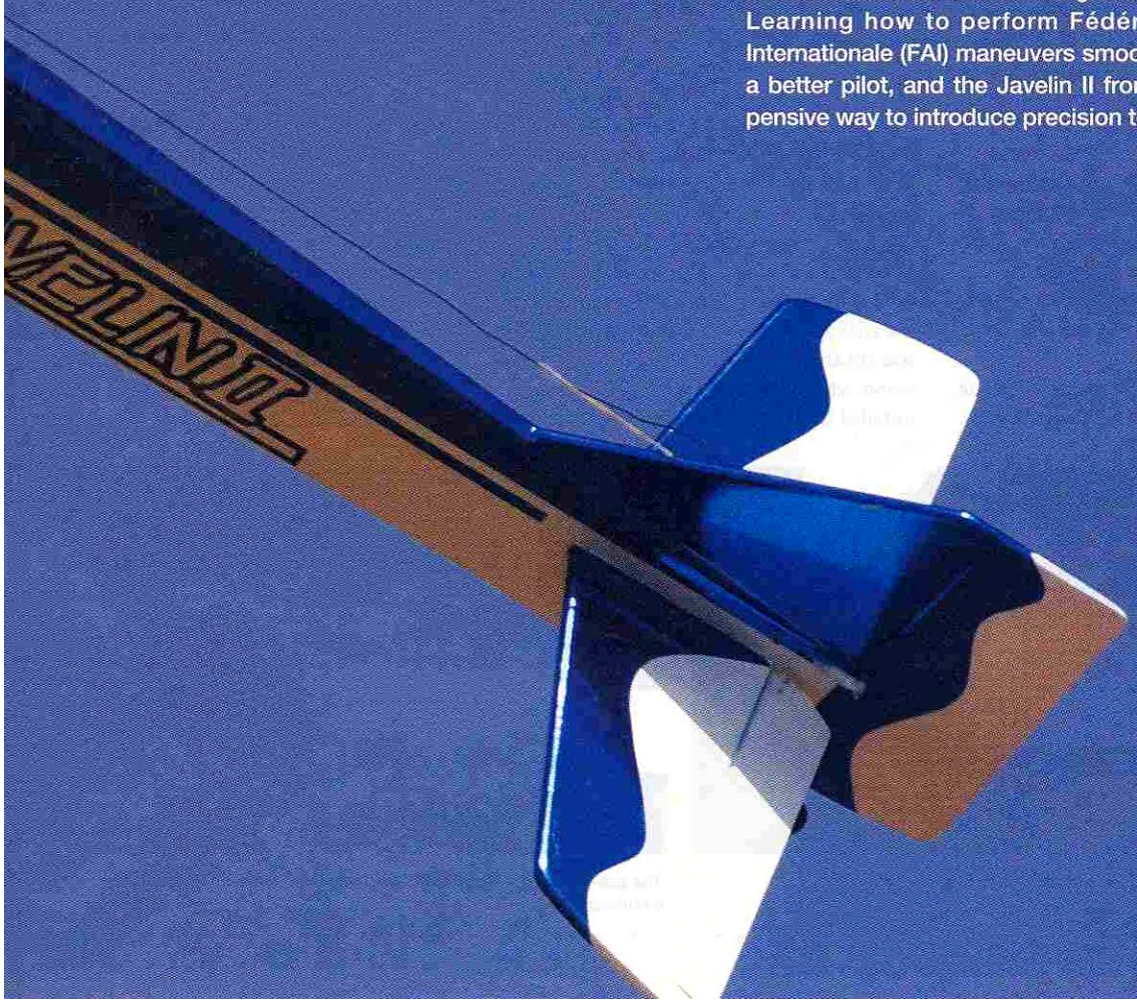
"... the Javelin II is easy to build and boasts good construction and great looks."

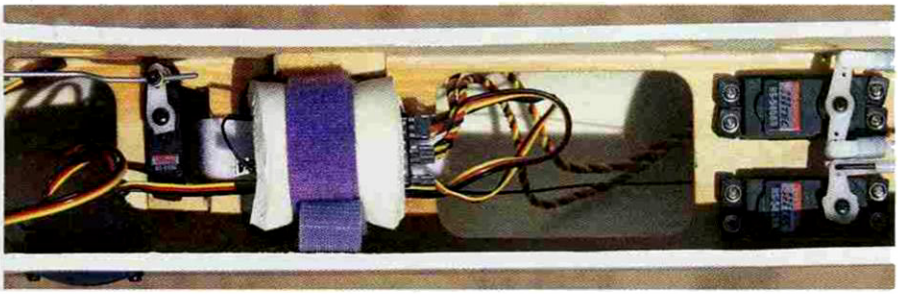
BY JET THOMPSON › PHOTOS BY JOHN REID

CERMARK Javelin II

A precision aerobat that's easy to build

IT'S NO COINCIDENCE THAT THE BEST 3D PILOTS in the world are also among the best pattern pilots. Learning how to perform Fédération Aéronautique Internationale (FAI) maneuvers smoothly can make anyone a better pilot, and the Javelin II from Cermark is an inexpensive way to introduce precision to your flight resumé.





The radio compartment has plenty of room for standard servos. The battery is slung directly below the receiver.

SPECIFICATIONS

MODEL: Javelin II
MANUFACTURER: Cermark
TYPE: precision aerobat
WINGSPAN: 58 in.
LENGTH: 61.5 in.
WEIGHT: 5.7 lb. dry
RADIO REQ'D: 4-channel w/5 servos
ENGINE REQ'D: .45 to .50 2-stroke or .60 to .70 4-stroke
PRICE: $169.95

COMMENTS

The Javelin II flies straight and true, and it's a great tool for learning and practicing precision aerobatics.

HIGHLIGHTS

- Good-looking color scheme
- Individually adjustable elevator halves
- Fiberglass cowl

GETTING STARTED

As is usual with Cermark kits, the contents of the box were well protected and undamaged. Everything was poly-bagged, and a complete set of high-quality hardware was included.

When I construct any plane, my first step is to carefully consider how I intend to fly it. A plane such as the Javelin II is intended to fly very precise maneuvers, so I decided to use 5-pole servos because of their superior centering characteristics. In my "box o' stuff," I happened to have 2 Hitec 525MG and 2 Hitec 545BB servos (all 5-pole servos), so I didn't need to run to the hobby shop. I also decided to use my trusty old YS63FZ engine because of its tremendous power for its size, its excellent throttle response and its reliability.

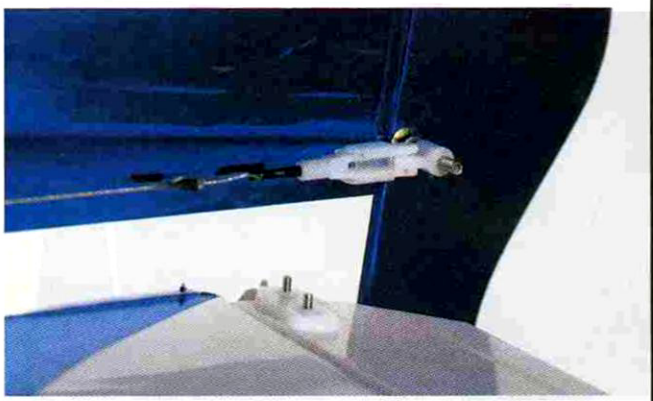
Wing. The Javelin II comes with a one-piece wing, and this speeds up assembly time considerably. The aileron servos are positioned on their sides inside the wing with only the control horns sticking out. This technique adds to the plane's sleek lines and reduces drag. The servos are mounted on the hatch covers, so all I had to do was align the servo arm with the slot that it goes through, mount a few hardwood blocks on the covers in the appropriate places and then mount the servos on the completed assembly. With the servos installed, I hinged the ailerons, installed the control horns and hooked up the pushrods. I routed the servo wires through the wing using a piece of string that Cermark has installed and then taped them into place.

One of the first things I check is that the wing is square with the fuselage. To do this, I installed the wing securely and measured from each wingtip to the vertical fin. In this case, the right wingtip was about ⅛ inch farther back than the left one. I decided to use small wooden shims in the front alignment slot to shift the wingtips until they were perfectly square. This was an easy way to dial in the wing, and it took less than 10 minutes.

Tail section. Another critical alignment in any model plane is that of the horizontal stabilizer and vertical fin. Since the vertical fin on the Javelin II comes installed, I didn't have to worry about aligning it. The first step was to center the stab in the fuselage. I measured along the leading and trailing edges from the sides of the fuselage to the tips of the stab halves to ensure that the distances were the same on both sides. Then I measured from the tip of each stab half to a point on the fuselage centerline. I stuck a straight pin into the fuselage just behind the canopy and used this as my reference point. When I was satisfied that the stab was straight, I marked it, removed it and cut and peeled away the covering to reveal wood where the join would be. I then reinstalled the stabilizer and fitted the wing into place. With this finished, I checked that my previous measurements still held true and then checked to make sure that the wing and horizontal stab were parallel with each other. When I was satisfied that no more adjustments were needed, I epoxied the horizontal stab into place and checked its alignment several times before the epoxy set up.

When it was time to install the elevator halves, I followed the manual's advice that it would be easiest to install the control horns on the elevators before they were joined to the stabilizer. After I had hinged the elevator halves into place, it was time to route the elevator pushrod. One of the really great features on the Javelin II is that it uses one elevator

Split elevator halves are great for precise fine-tuning.



The pull-pull rudder system provides positive control throughout the excursion range.

IN THE AIR

This is a great platform to get any pilot tuned up on pattern maneuvers, and it's gentle enough to be a very good Sunday sport plane as well.

CONTROL THROWS

Elevator: ±¾ in. (high); ±⅜ in. (low); expo: 25% (low), 35% (high)
Aileron: ±⅝ in. (high); ±⅜ in. (low); expo: 20% (low), 30% (high)
Rudder: ±1¼ in. (high); ±¾ in. (low); expo: 20% (low), 35% (high)

GENERAL FLIGHT CHARACTERISTICS

- **Stability:** this is a great plane for pilots who want to step up from their first tail-dragger and get serious about aerobatics.
- **Tracking:** flying straight lines and smooth curves is the hallmark of a good pattern ship, and the Javelin performs quite nicely.
- **Aerobatics:** these are precise and graceful. The Javelin II is excellent for polishing your pattern skills.
- **Glide performance:** I expected to have my hands full in the event of a dead-stick, but I was nicely surprised.
- **Stalls:** when forced to the edge, the Javelin stalls predictably and flies away from it with a little throttle.

PILOT DEBRIEFING

Aerobatic performance is where the Javelin II is most graceful. It isn't a 3D type of airplane but is intended to do pattern-type precision aerobatics. It is no coincidence that the best 3D pilots in the world are also among the best pattern pilots. Learning how to perform the pattern maneuvers smoothly can make anyone a better pilot, and this is an inexpensive way to introduce precision to your flight skills.

The Javelin II tracks perfectly through loops and up-lines. There is very little pitch coupling in knife-edge flight, but a bit of aileron is necessary to keep the wing perpendicular. With the wing adjusted to be square with the fuselage and the elevator halves adjusted correctly, I can pull very hard corners for square loops without introducing any roll. Spins and snaps are quite slow and graceful, and rolls are very much on axis. Point rolls require the proper coordination of rudder and elevator, and they look impressive when done properly.

pushrod that's split at the elevator end so that each elevator half can be individually tweaked for fine-tuning. The drawback to this is that it makes it tough to route the pushrod through the end of the fuselage. Through some experimentation, however, I found that if I first fed a tube from each of the pushrod exit holes forward to the radio compartment and then put the pushrod ends into the tubes and fed the pushrod back, the ends popped out at their assigned exit holes.

After the elevators had been hooked up, it was time to install the tailwheel, the rudder and the rudder linkage. The tailwheel and rudder are typical installations, and the rudder linkage is a pull-pull setup—not very common in a plane of this size. Installation is not difficult, but care must be taken to ensure that the wires do not get tangled around the elevator pushrod.

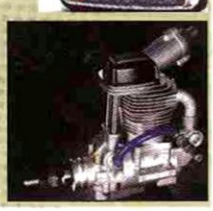
GEAR USED

BATTERY: Sanyo 600mAh 4-cell

RADIO: JR XP8103 transmitter, 2 Hitec HS525MG servos (ailerons), 2 545BB servos (1 elevator, 1 rudder), 1 Hitec HS81MG servo (throttle)

ENGINE: YS63FZ, APC 12x7 propeller

FUEL: Powermaster 20/20



Engine. In keeping with the rest of this plane's clean lines, the engine is enclosed in the cowl and is therefore mounted inverted. Cermark includes an engine mount with the kit, and the engine-mounting holes have been drilled and blind nuts installed. The manual suggests that pilots who intend to use 4-stroke engines may have to re-drill the mounting holes to accommodate their wider engines, but I had no such issue with the YS.

The fuel tank fits just behind the firewall, and the front of it protrudes through the firewall to give easy access to the fuel lines. To keep the tank in place, I surrounded it with foam and then glued a piece of scrap balsa behind it. I found the spot where I wanted the throttle pushrod to pass through the firewall, drilled a hole there and attached the rod to the engine throttle arm with a ball joint. I put a couple of bends in the pushrod so that it would clear the fuel tank, and I connected it to the servo with an adjustable pushrod connector.

With the engine in place, I used a rotary tool to make cutouts in the fiberglass cowl to accommodate the muffler, the high- and low-end needle valves, the fuel-tank pressure line and the ever important glow plug. When I use a rotary tool to cut fiberglass, I always wear a facemask. Fiberglass dust is not something you want to inhale.

FINISHING TOUCHES

I now located the plane's center of gravity (CG) so that I'd be able to install my receiver and battery to achieve a good balance point and not have to add any dead weight. Since the Javelin II has such a long tail moment, I figured I'd have to mount the battery at or near the firewall—probably under the fuel tank. As it turned out, the CG was almost dead-on; if anything, the plane is slightly nose-heavy. For my initial flights, I had the CG in the middle of the recommended range, so I mounted the receiver and battery just aft of the throttle servo. It's nice that Cermark has marked the outside of the fuselage to indicate the center of the CG range. I wrapped the receiver and battery in foam rubber and used Velcro® strips to hold them in place. The landing gear is mounted on the wing and is held in place with straps and screws. Last, I adjusted the control throws as recommended in the manual and tightened all of the screws.

Overall, the Javelin II is easy to build and boasts good construction and great looks. I especially like the way the metallic blue covering sparkles in the sun. Because I had been so picky about ensuring that everything came out square, I had to make only minor trim adjustments. The result is a very good plane that flies where I point it and is great for practicing precision aerobatics.

See the Source Guide on page 152 for manufacturers' contact information.

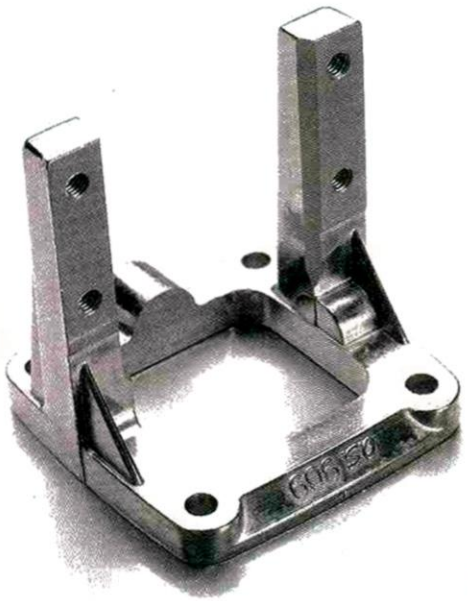
ENGINE TECH

Your guide to engine installations

WHEN IT COMES TO PULLING A MODEL airplane through the sky, it all boils down to the stuff in front of the firewall: the engine and the engine mount. A properly set up powerplant and mounting system helps to minimize noise and vibration, and it maximizes safety and power transfer to the propeller. If you plan to install an internal-combustion engine in your model, you have to do it right. Here's how!

BY GERRY YARRISH PHOTOS BY DERON NEBLETT

Engine mounts are available molded of plastic (such as this one from Carl Goldberg Products) or made of aluminum. Both types are easy to use and install.



Several mounts are available custom-drilled and sized for specific engines. These save setup time.

SETUP CONSIDERATIONS

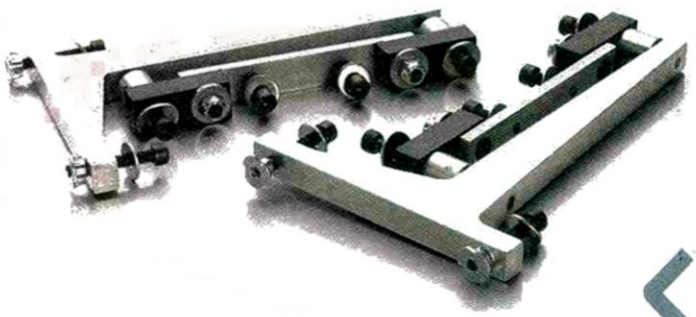
Before you bolt your engine to the firewall, consider the requirements of the engine type and configuration, the fuselage and firewall layout, engine cooling, the cowl construction, the horsepower output and the carb position; these are the factors that most affect the engine installation.

ENGINE MOUNTS

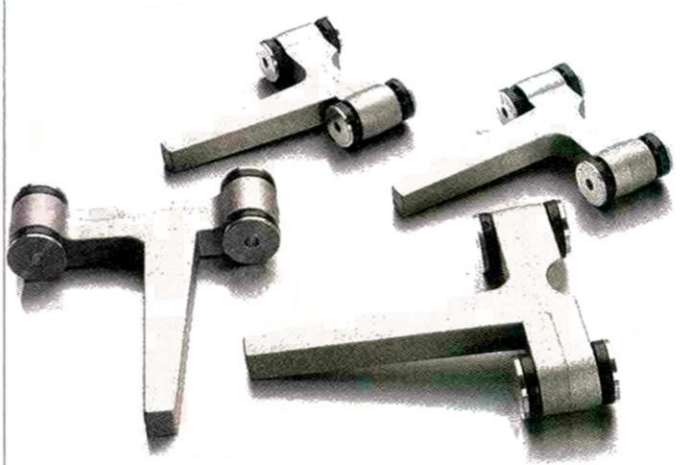
The hardware that supports the engine and attaches it to the rest of the airplane is the engine mount, and it comes in a variety of shapes and materials. One- and two-piece mounts are available, and they are made of metal (usually aluminum) or molded plastic. Some engines come with their own mounts, and some mounts are designed as part of the engine case. For large gasoline engines, a simple metal plate serves as the mount; it comes bolted to the back of the engine case. There are also cup-shaped engine mounts for gas engines; these increase the distance between the firewall and the propeller. These mounts also help draw heat away from the engine.

Several companies offer custom-designed, predrilled mounts that fit specific engines. Though they cost a bit more than the mounts you have to drill yourself, custom mounts save time and offer precise machining for strong support. Also available are adjustable mounts that fit a range of engine sizes.

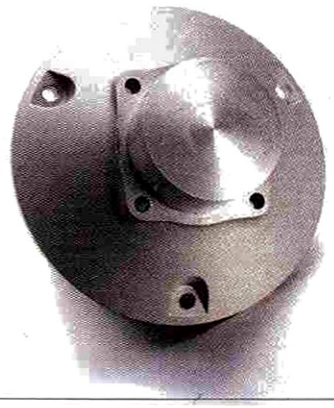
Engine mounts come in two basic types: hard and soft. Hard mounts provide a solid frame that you bolt directly into place on the firewall. Soft mounts provide a firm but flexible engine installation that helps to isolate the rest of the model from engine vibration. Both types work well, but I prefer to use hard mounts on all my airplanes except those with very light and delicate construction.

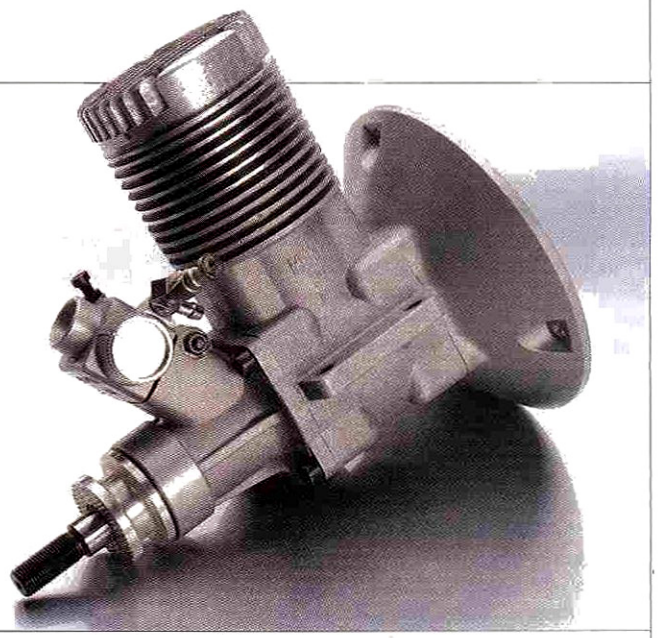


Available from Dave Brown Products, these Vibra-Damp mounts are avalable for popular 4-stroke engines and come predrilled and tapped.



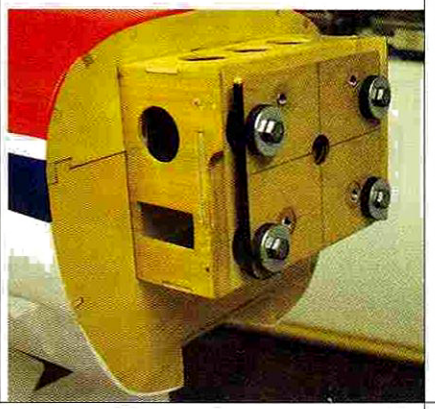
These Du-Bro Vibra mounts are very popular and come with replaceable rubber isolators.



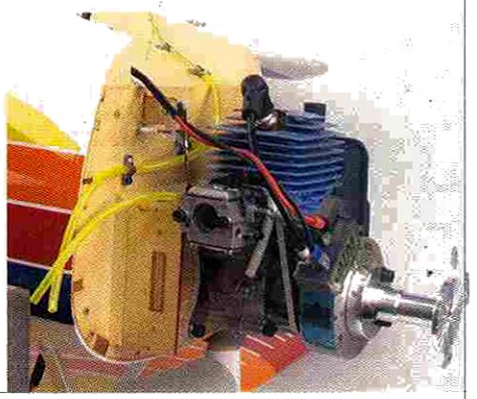


Engine mounts are sometimes part of the engine. Here, a Moki 1.80 has a radial engine mount that replaces the engine's backplate.

Great Planes offers a large, gas-engine isolation mount that's made of plywood and is installed between the engine and the firewall. Four rubber pads help absorb engine vibration.



For most gasoline engines, the engine mount is a flat, aluminum plate that is bolted to the back of the engine case. Here, a Fuji 50cc engine has been "hard mounted" to the engine-mount box structure in the front of a Great Planes Christen Eagle. Notice the offset throttle linkage using a 90-degree bellcrank.

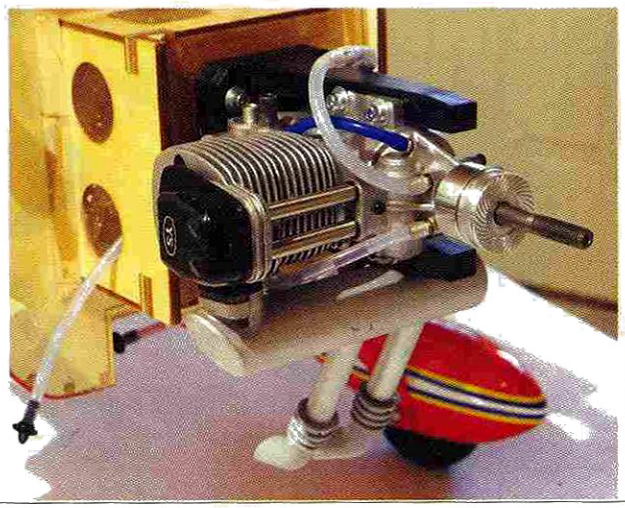


Available from Nick Ziroli Plans, these gasoline-engine soft mounts offer different amounts of vibration damping according to the hardness of the mount you use. They are color-coded to different engine sizes.

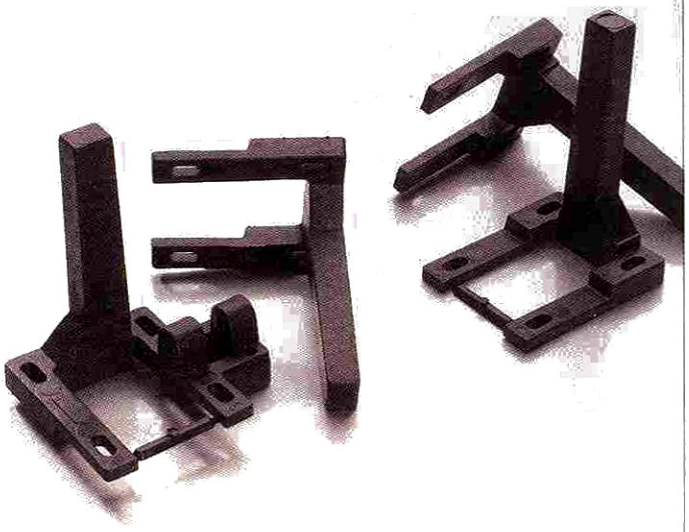
Davis Model Products makes these Iso-mount inserts to isolate engine vibration from the rest of the model. They are easy to install, and you can adjust the amount of vibration damping by tightening and loosening the screws.

NUTS AND BOLTS

There are two ways to bolt your engine to its mount: drill holes all the way through the mount beams and use washers and locknuts to secure the attachment bolts, or drill and tap the beams to match the holes in the engine's side lugs. Depending on the size of the engine, the attachment bolts range in size from 4-40 to 8-32. The size of the holes in the lugs typically dictates the bolt size. Since engine cases are made of aluminum, it is best to install flat washers under the heads of the attachment bolts and under the locknuts (if you use them). This will help prevent the nuts and bolts from wearing the mounts' softer material.



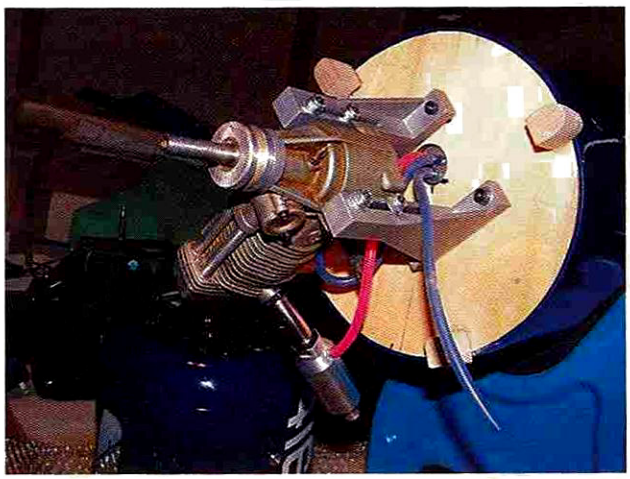
This YS 1.20 4-stroke engine is side-mounted (horizontally) and uses a Pitts-style muffler to guide the exhaust straight downward. The plastic engine mount has been drilled and tapped for the engine-attachment bolts.



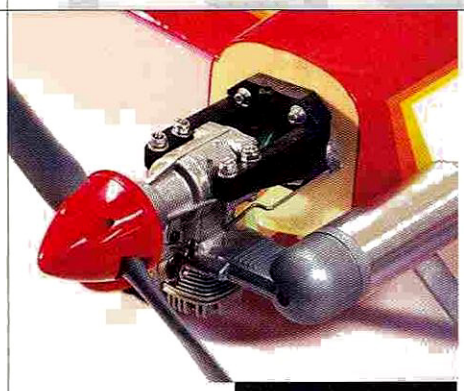
Several adjustable mounts come molded out of durable plastic. These adjustable mounts from Carl Goldberg Products have slotted bolt holes so they can be made wider or narrower to suit the engine.

ADJUSTABLE MOUNTS

To provide a one-size-fits-all arrangement, several manufacturers offer adjustable engine mounts. These include mounts with slotted attachment rails and those with clamping plates that fit over the engine-attachment lugs. Two-piece mounts are adjustable by design, as engine width affects how far apart they are bolted to the firewall. Whenever you use adjustable mounts, be sure to follow the instructions closely for proper engine support.



Here is an adjustable engine mount bolted to a Hangar 9 Corsair. The two mounting brackets are made of aluminum, and the attachment holes are slotted to accept a wide range of engine sizes.



This engine installation is typical of most .40-size sport models. The engine is inverted and uses a one-piece, molded-plastic mount. Notice the locknuts used to secure the attachment bolts.

FIREWALLS

FIG. 1 BASIC ENGINE MOUNT

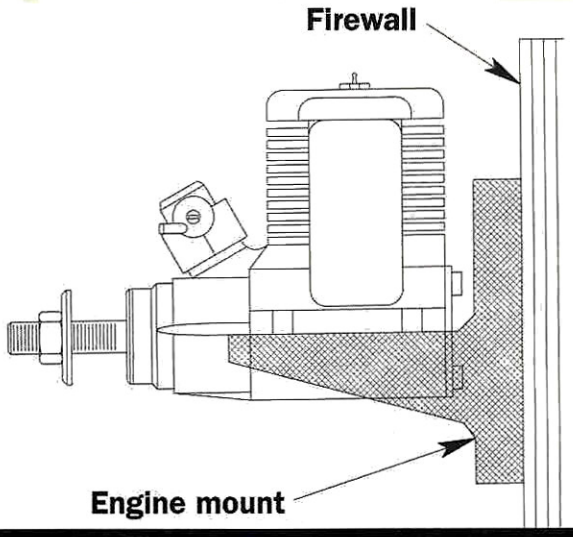


FIG. 2 BOX STRUCTURE

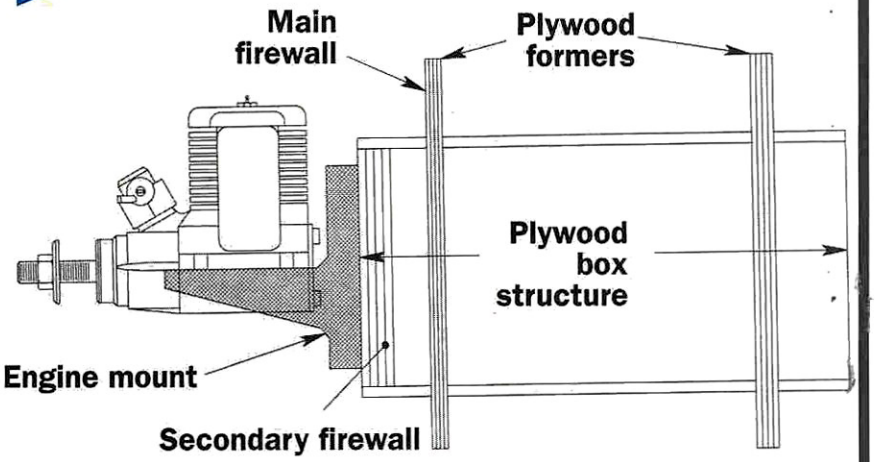
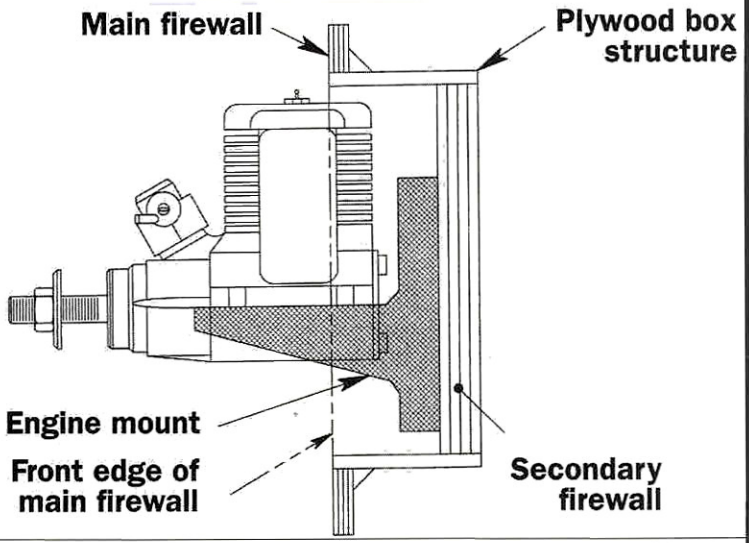


FIG. 3 RECESSED FIREWALL



FIREWALL CONFIGURATION

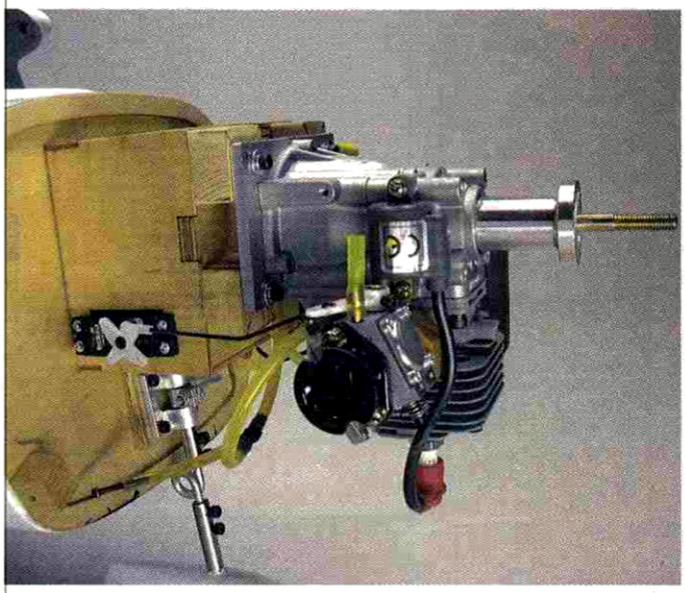
Typically made out of strong, multi-layer plywood, the model's firewall design must be considered before you install your engine and engine mount. In most models, the firewall is a flat, vertical structure in which you need only drill holes for the bolts (Fig. 1). You then install blind nuts or locknuts to secure the installation. Most trainer and sport models use this arrangement, and so do many scratch-built scale models. It is simple and very strong.

Found in scale and aerobatic models, the engine mount-box structure is becoming very popular (Fig. 2). Basically, this is a plywood box that's built into the fuselage to tie the firewall into the first and second formers. The box helps distribute stress loads and is a strong, relatively light structure. In many kit-built airplanes, this box can be slid into and out of the fuselage to accommodate various engine lengths.

A recessed firewall (Fig. 3) is used when an engine is too long for the cowl. Used primarily in scale airplanes, this is an inverted box structure that protrudes into the fuselage.

An old-time—but still very acceptable—way to attach the engine to the model is to build two long, hardwood rails (usually made of maple) into the firewall. This arrangement distributes stress loads over a number of formers for a very secure engine installation. The rails are usually drilled and tapped for the engine-attachment bolts.

"... A well-thought-out, properly equipped **engine** installation is the **foundation** for **trouble-free** operation."



Many modelers now install the throttle servo in front of the firewall and run a short pushrod to the throttle arm. Be sure to avoid metal-to-metal contact by replacing the steel throttle arm with a plastic one.

THROTTLE LINKAGE

For reliable engine operation, make sure that the pushrod or throttle cable you use to operate the carburetor is installed properly. Once the engine and mount have been installed, mark the location of the throttle-linkage exit so that the throttle linkage will operate smoothly. Make the exit hole large enough to allow slight side play as the throttle arm moves from full throttle to full idle. Several connectors are available to attach the linkage to the throttle arm, including clevises, ball links and EZ connectors. Avoid using a Z-bend with an aluminum throttle arm, as this produces metal-to-metal contact that can cause radio interference. Z-bends work fine with plastic arms.

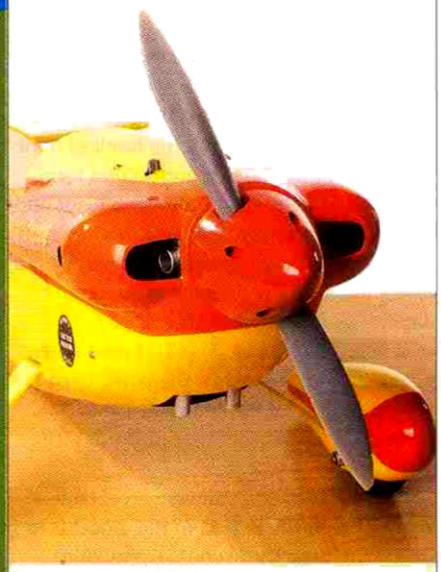
FUEL TANK LOCATION

It is also important that you install your fuel system properly. To maintain a proper fuel flow, install the fuel tank so that its centerline is at or just slightly below the carburetor's centerline. With large gasoline engines, tank position is much less critical; they are equipped with pumper carbs that can draw fuel regardless of where the tank is placed. When you drill holes through the firewall for the fuel and vent lines, make them large enough for the lines to pass through easily; a tight fit will chafe the lines and eventually cause them to leak. I prefer to drill a single large hole and then pass all the fuel lines through it. This also makes installing and removing the tank easier than when you try to feed three lines through three different holes.

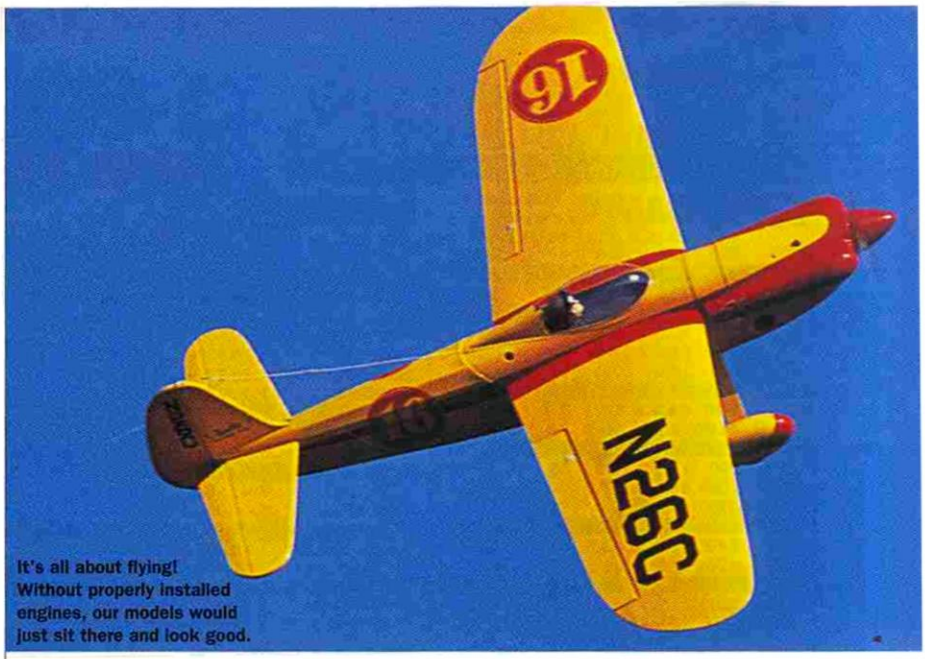
A COOL ENGINE IS A HAPPY ENGINE

ENGINE COOLING

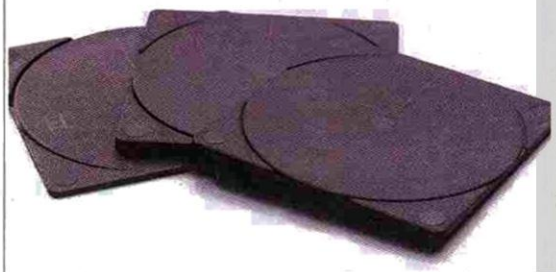
Regardless of which engine mount you use, cooling is critical to any engine installation. When you use an engine cowl to improve aerodynamics or appearance, make sure that there is an adequate airflow to draw unwanted engine heat away. The basic rule is to provide twice as much exit area as inlet area. If you have 2 square inches of air inlet, the exit should be at least 4 square inches. With large, roomy engine cowls in which there is abundant dead-air space around the engine, you may have to install sheet plywood or aluminum baffles to direct the airflow around the engine head. You can't get maximum engine performance without proper cooling.



Tight engine cowls such as the one on this Great Planes Shoestring racer require proper engine cooling to prevent the engine from overheating.



It's all about flying! Without properly installed engines, our models would just sit there and look good.



These engine-thrust plates from Ernst are used to adjust the engine's right and down angle. They are installed between the firewall and the engine mount.

ANGLED ENGINES

ENGINE-THRUST OFFSET

DEPENDING ON THE TYPE OF MODEL airplane you have, a few degrees of engine-thrust offset (usually right and down) is required for it to fly properly.

To add offset, adjust the engine on its engine-mount rails or angle the entire engine-mount assembly. The mount can be angled by adding a wedge-shaped spacer or by installing a few washers under one side of the mount. The thrust angle can also be built into the firewall, where it is glued into place at the desired angle. The engine mount is then simply bolted to it.

When you add right thrust, you should offset the engine-mount placement slightly to the left of the firewall's vertical centerline. Typically, 1/8 to 3/16 inch is enough for 2 degrees of right thrust. Offsetting the engine keeps the prop shaft centered at the cowl nose.

CONCLUSION

All that's left is to check the details and make sure that everything is tight and properly secured. Having a well-thought-out, properly equipped engine installation is the foundation for trouble-free engine operation. Keep everything simple and well organized.

See the Source Guide on page 152 for manufacturers' contact information.

continued from p. 92

BY C. DAVID GIERKE

O.S. FL-70

A revolutionary 4-stroke design

Twenty-eight years after it marketed the first mass-produced 4-stroke, O.S. has released its latest masterpiece: the FL-70. According to the accompanying literature, this single-cylinder, air-cooled, overhead-valve 4-stroke engine "... is suitable for trainer, sport and scale models." In addition, "This engine reduces maintenance by incorporating the first O.S. ringless piston/liner assembly. Also, a sealed front bearing prevents oil leaks. This engine is designed so that more pilots, from hobby beginners to skilled Sunday fliers, may enjoy the performance advantages of 4-stroke engines: greater fuel economy, higher torque, lower noise and realistic sound."

DESIGN FEATURES

Any new engine that crosses my bench is subjected to basic measurements and a perusal of its specifications from the instruction manual. Over the years, I've digested statistical data from hundreds of engines; it's what "engine nuts" do! I did a double-take, however, when I read the FL-70's bore and stroke data. It has a bore of 27.7mm (1.090 inch) and a stroke of 19.0mm (0.748 inch), so a quick calculation revealed a bore/stroke ratio of 1.457:1—the highest I've ever seen. Although the ratio of bore to stroke has nothing to do with torque delivered to the crankshaft, big-bore, short-stroke engines can lay claim to certain performance and longevity benefits (see the "Bore/Stroke" sidebar).

The FL-70 incorporates a very short connecting rod. When a short connecting rod is used with a high bore/stroke ratio, the result is a compact (height-wise), low-weight design. Short connecting rods have one objectionable feature: they produce greater rod angularity at mid-stroke than designs with longer rods. Excessive rod angularity acting through the piston generates undesirable side-thrust loads on the cylinder wall, increasing the likelihood of power loss due to friction. The FL-70 has a connecting-rod length (center to center) -to-stroke ratio of 1.64:1—decidedly on the low side. It's interesting to observe the compromises that designers make to achieve an objective—in this case, producing a compact, lightweight, 4-stroke engine with a high power-to-weight ratio.

Although the FL-70 is O.S.'s first ringless design, model engines without rings have been produced since the 1930s. Until recently, large 4-stroke engines (those with a greater than 0.60ci displacement) have used Meehanite (fine-grain iron) rings to ensure a good gas seal between the piston and cylinder wall. With the advent of CNC machinery, engine manufacturers are able to maintain much closer tolerances (fit) when fabricating matching parts such as lapped (ringless) piston-and-cylinder assemblies. The ringless assembly does have disadvantages, such as piston wear and early loss of the compression seal, but this deficiency is somewhat offset by the engine's relatively low piston speed, as detailed in the "Bore/Stroke" sidebar. A special note accompanies the FL-70 to inform the purchaser: "... the piston will feel tight at the top of its stroke, or top dead center (TDC), when the engine is cold." Users of 2-stroke model engines are familiar with this interference-fit condition; known as "pinch," it typifies modern lapped-piston designs.

For the FL-70, O.S. uses a proprietary system known as ABN (aluminum piston with a brass cylinder sleeve that's nickel-plated). Nickel-plated brass does a better job of "wetting" its surface with lubricating oil than chrome-plated brass sleeves. Chrome rejects lubricant (imagine water running off a

ENGINE HIGHLIGHTS

- Short break-in period
- Smooth, easy, kickback-free operation
- Compact, lightweight design
- Excellent power per pound
- Carburetor is easy to adjust
- Rear-positioned glow plug for safe operation

TEST CONDITIONS AND PERFORMANCE VALUES

Temperature: 51 deg. F
Barometric pressure: 28.96 in. Hg
Wet-bulb temperature: 48 deg. F
Horsepower correction factor: 1.034
Peak torque: 105.3 oz.-in. @ 10,150rpm
Peak power: 1.1 bhp @ 10,150rpm
Specific torque: 150.4 oz.-in./ci
Specific power: 1.57 bhp/ci
Power/weight: 0.97 bhp/lb.

The FL-70 disassembled.

duck's back). Although chrome plating has long been recognized for its durability, O.S.'s ABN system achieves improved piston longevity while maintaining the critical compression and combustion-gas seal that is needed for reliable starting and long-lasting, wide-open-throttle (WOT) performance.

Another noteworthy design feature of the FL-70 is the composite-plastic rear cover that contains the crankcase breather nipple. The breather nipple is connected by a length of medium-size silicone tubing to a similar nipple on the muffler. Excess oil is forced from the engine's crankcase to the muffler, where it is discharged along with the exhaust—a clever solution to an age-old disposal problem for 4-stroke engines.

CONSTRUCTION NOTES

Carburetor. The engine is fitted with the new, easy-to-use, one-piece O.S. 60W air-bleed carburetor/intake manifold. Two adjustable controls are provided on this carburetor. The needle valve is used to establish the correct mixture strength required for full power when the throttle is full open, and the airbleed screw is used to find the correct mixture strength needed for steady idling and a smooth transition to medium speeds. The mixture strength between medium speeds and full-throttle operation is automatically adjusted within the carburetor, specifically for the FL-70. The 60W carburetor/manifold is an updraft unit that is "hung" behind the cylinder in typical O.S. fashion.

Valve train. The engine's overhead poppet valves are activated by rocker arms, pushrods and lifters from the transverse-(crosswise-) mounted camshaft that is actuated by the crankshaft and located directly behind the drive hub. The gear drive for the cam is spiral-cut into the aft portion of the crankshaft journal (directly behind the counterbalance). The one-piece crank is fully counterbalanced and case-hardened, along with the gear teeth, for long, trouble-free operation. The cam gear must be driven at ½ crankshaft speed to actuate the valves in accordance with the piston's motion. As you know, 4-stroke engines complete two revolutions of the crankshaft during a single cycle. During this time, the intake and exhaust valves each need to open only once. Therefore, the camshaft rotates at ½ crankshaft speed.

Piston, connecting rod and wristpin. The piston is made of high-silicon aluminum-alloy bar stock and is quite short. Since—unlike 2-strokes—4-stroke pistons aren't required to open and close cylinder ports, their skirt length can be made as short as is practical without introducing unwanted piston rocking. Therefore, 4-stroke pistons are lighter, thereby reducing destructive inertial loads of reciprocating components that change directions twice for each crankshaft revolution. Two shallow, oil-retention grooves are machined in the cylindrical portion of the piston, near the crown; the additional lubrication helps to reduce friction due to cold start-up pinch near TDC. The connecting rod is made of a tough aluminum-alloy bar-stock material and is bronze-bushed only at the crankpin. The wristpin is made of hardened, ground steel and is fitted with a Teflon pad at each end to prevent the cylinder wall from being scored.

Crankshaft seal. The FL-70 is fitted with a sealed front crankshaft ball bearing. Though this is not unusual, O.S. nevertheless claims that the heavy-duty seal stops potential oil leaks from that location. In the past, these seals only kept dirt and debris from entering the bearing; they didn't prevent crankcase oil from exiting the engine. Since my test example didn't leak, I surmise that the system works.

SPECIFICATIONS

Engine: O.S. FL-70
Distributor: Great Planes Model Distributors
Displacement: 11.45cc (0.698ci)
Bore: 27.7mm (1.090 in.)
Stroke: 19.0mm (0.748 in.)
Bore/stroke: 1.457/1
Stroke/bore: 0.69/1
Rod length/stroke: 1.64/1
Practical rpm: 2,300 to 12,000
Weight (w/out muffler): 467g (16.47 oz.)
Weight (w/muffler): 515g (18.16 oz.)
Shaft nose thread: UNF ¼-28
Carburetor choke bore: 7mm (0.276 in.)
Overall height: 107.5mm (4.23 in.)
Overall width (w/out muffler and manifold): 54mm (2.125 in.)
Overall length (w/out muffler and manifold): 137.5mm (5.413 in.)
Glow plug: O.S. type F
Fuel used: 10-percent nitro, 20-percent oil, 70-percent methanol
Price: $190

PROPS & POWER

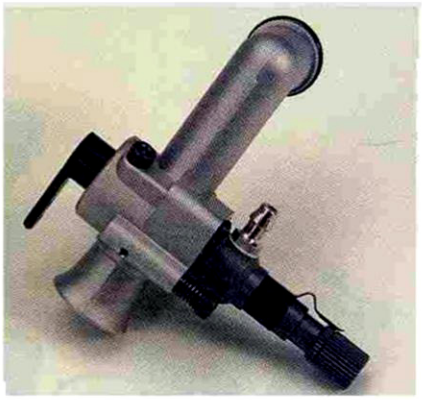
The O.S. FL-70 is a bit unusual for a 4-stroke design because it produces its best torque at the same rpm as its best horsepower: 10,150rpm (see points "A" in the graph). This isn't a bad thing! You'll optimize power if you're able to run the engine anywhere close to its best horsepower speed and with a propeller suited to your model's flight characteristics. For example, a slow-flying scale biplane would be better suited to a 14x5 propeller than a 12x7, which is better suited to a low-drag sport model that's intended to fly faster. From the propeller rpm data, notice that the FL-70 engine turns both the 14x5 and the 12x7 props at 10,000rpm. Either of these propellers is ideally suited to this engine, especially when in-air propeller unload (200 to 300rpm) is added to the static rpm.

APC PROPELLER RPM

SIZE	RPM
11x6	11,950
11x8	10,700
12x6	10,450
12x7	10,000
14x5	10,000
12x8	9,150
13x7	9,050
12x9	8,950
13x8	8,900
12.5x10	8,200

OTHER PROPELLERS

Propeller rpm data indicates that although the 12x6 operates somewhat beyond the maximum torque and bhp points, it still produces within 11 percent of the maximum torque and 7 percent of the max bhp, considering a 250rpm unload (see points "B" on the graph). A 12.5x10 propeller was the heaviest load tested with this engine, which turned it at 8,200rpm. This still produced within 13 percent of the maximum torque and 27 percent of the max bhp, again considering a 250rpm unload (see points "C" on the graph). All but the two smallest propellers (11x8 and 11x6) are candidates for flying models of different air-drag and speed requirements with the FL-70 engine.



The unique 60W carburetor/intake manifold assembly is die-cast with a hardened and ground steel rotary barrel. The air-bleed design requires only a primary needle valve and an air-bleed screw for adjustment.

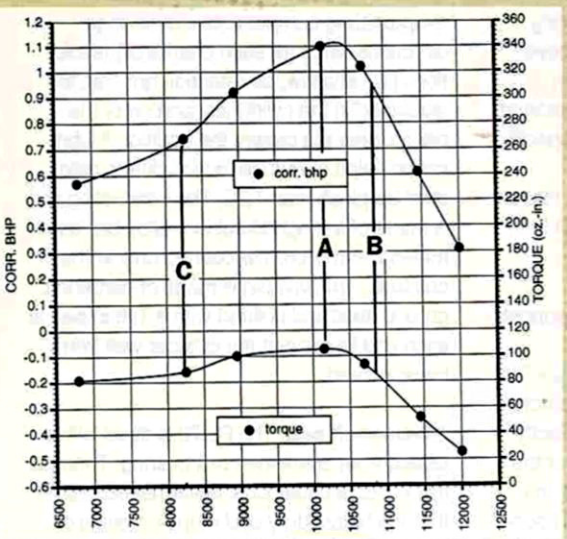
Castings, cylinder head, gasket, glow plug and drive hub. All castings are die-cast and are represented by the crankcase, cylinder head, drive hub, carburetor housing/induction manifold and cam-housing cover. The cylinder-head assembly is fastened to the crankcase casting with four metric Allen-head machine screws; this arrangement clamps the upper flange of the cylinder sleeve securely into place while allowing the sleeve body to "float" within the crankcase. This minimizes distortion, friction and the inevitable loss of power. A single 0.007-inch-thick brass head gasket pressure-seals the head/crankcase interface. The O.S. F glow plug is in the cylinder head, behind the rocker covers, and it's angled to the rear—well away from the rapidly rotating propeller. The drive hub is locked into place by a pin that passes transversely through the front journal of the crankshaft and directly under the drive hub. A matching groove at the rear of the hub indexes with the pin, providing a positive slip-proof connection. My only complaint with the system concerns the pin: it can easily slip from the crank and become lost when changing propellers. Perhaps it could be retained with a bit of Goo all-purpose adhesive.

The intake and exhaust valves are shown within the wedge-style combustion chamber of the FL-70's cylinder head, along with the adjacent glow-plug port. The brass gasket/spacer is interposed between the head and the cylinder-sleeve flange. Note the extended nose of the type-F O.S. 4-stroke glow plug. This feature helps keep the glow-plug element hot during the engine's operation.

IDLE RPM AND SOUND CONSIDERATIONS

After break-in and dyno testing, I checked the engine for idle and transition to WOT. After a minor air-bleed screw adjustment, the FL-70 idled at a consistent 2,200rpm and exhibited a crisp throttle-up after a 30-second idle. The sound level was a quiet 88dB @ 8,900rpm (13x8 prop) and 90dB @ 10,000rpm (12x7 prop).

Torque & bhp vs. rpm



READING THE GRAPH

To determine the torque and brake horsepower (bhp) values generated by a propeller, find its rpm on the "Torque and bhp vs. rpm" graph; then draw a line vertically through the torque and bhp curves. Transfer the points of intersection to the scales on the right and left to determine torque and bhp. Note: brake horsepower is calculated using measurements (torque and rpm) on an engine dynamometer.

BORE/STROKE

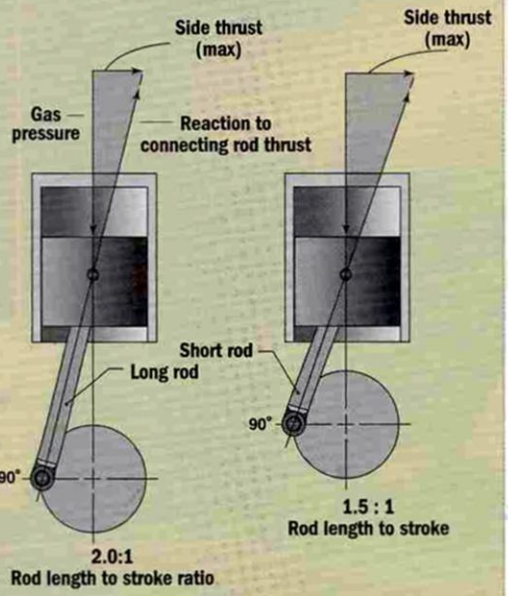
Many engine reviewers faithfully recite the engine's bore/stroke ratio or its reciprocal: stroke to bore. Why is it important? Bore refers to the cylinder's inside diameter, while stroke pertains to the distance traveled by the piston from one limiting position (TDC) to the other (bottom dead center, or BDC). There's a progression of practical stroke/bore ratios that ranges from about 1.5:1 (long stroke) to about 0.8:1 (short stroke). When reference is made to individual combinations within this range, engines that have an equal bore and stroke are termed "square." Long-stroke engines with smaller bores are simply known as long-stroke designs. Designs that have short strokes and larger bores, such as the O.S. FL-70, are called "over square."

There are some practical reasons for designers to use the over-square configuration. First, short-stroke engines produce short, compact designs when compared with long-stroke units. This cuts engine weight and improves the power-to-weight ratio. Second, long-stroke engines generate higher piston speed than square or over-square designs of the same displacement and rpm. The relationship is direct: when the stroke increases, piston speed increases along with friction and wear. Because of their relatively low piston speed, over-square designs such as the FL-70 produce less inertial force throughout the cycle of operation where the piston, wristpin and upper portion of the connecting rod change directions twice per revolution of the crankshaft. Physics explains that a piston's inertial force increases as the square of its rpm increase. Simply stated, as engine speed increases, the force attempting to tear the engine apart increases very rapidly.

One drawback concerning the over-square design: there's a greater possibility of gas leakage (blowby) around the piston because of its greater circumference. Other factors play a role in the bore/stroke story, including two myths: the greatest torque is always produced in long-stroke designs, and the engine is unable to burn fuels efficiently in relatively small-bore combustion chambers.

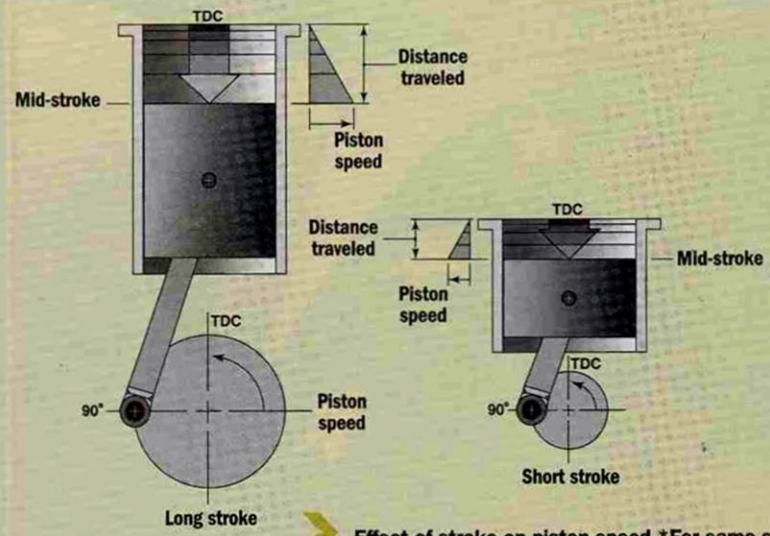
For these discussions and much more, my book "Two-Stroke Glow Engines for R/C Aircraft" is available from rcstore.com.

Side thrust vs. rod angle

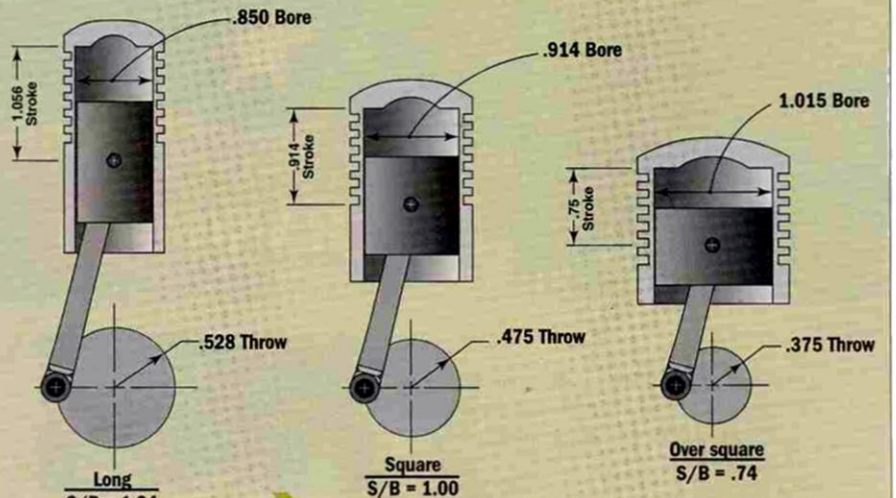


O.S. RECOMMENDED BREAK-IN PROCEDURE FOR THE ABN FL-70 :

1. Use the same prop as you'll use on your model.
2. Use 5- to 15-percent-nitromethane fuel containing at least 20-percent lubricating oil; the remainder is methanol (alcohol).
3. Open the needle valve 2½ turns from the closed position.
4. Set the throttle to idle.
5. Start the engine.
6. Open the throttle slowly to the mid-speed position.
7. Disconnect the current to the glow plug.
8. Fully open the throttle and adjust the needle valve to produce nearly maximum rpm. Run the engine for no more than 5 seconds before richening the needle about one full turn.
9. Repeat this process, alternately running the engine fast and slow by means of the needle valve; keep the throttle fully open.



Effect of stroke on piston speed *For same shaft speed



Stroke-bore combinations *Displacement: .61ci (10cc)

FEATURES

A short-stroke, large-bore, over-square design with a lapped ABN piston and cylinder; composite-plastic rear cover with crankcase breather nipple; design specific (O.S. no. 60W) updraft, air-bleed carburetor; leak-proof crankshaft ball-bearing seal; precision die castings; O.S. type-F 4-stroke glow plug; baffled expansion-chamber muffler; low noise production; easy to adjust, smooth, no-propeller-kickback operation.

10. Extend the short periods of high-speed operation until two, 24-ounce tanks of fuel have been consumed.

I used an APC 12x6 propeller and 10-percent-nitro fuel containing 20-percent oil (half castor, half Klotz KL-100 synthetic). My only deviation from the suggested procedure was to run the engine close to maximum rpm at startup and then alternately richen the mixture by 300rpm during each of approximately 15, individual 2-minute runs. This follows my long-held belief that ABC-type engines should be run at, or near, their maximum WOT cylinder-head temperature. Allowing the engine to cool excessively (such as during prolonged periods of rich operation) causes the cylinder to contract, thereby reducing its clearance to the piston. When the piston and cylinder make contact within the narrow pinch zone, rapid wear and loss of compression/combustion seal occur.

After about 30 minutes of running, the engine's peak rpm increased by 450, and it still maintained its pinch at room temperature. After a grueling session on the performance-determining dynamometer, where the engine is never allowed to cool, the FL-70 emerged with its excellent piston-cylinder fit intact.

CONCLUSION

The O.S. FL-70 4-stroke is a sweet-running engine. It's easy to adjust and forgives inadvertent over-lean needle-valve adjustments without detonation (that "pinging" sound). It also never tries to kick back (a nasty tendency of some 4-stroke engines that often loosens—or throws—propellers). On several occasions while dyno-testing the FL-70, it occurred to me that it would be a perfect engine for first-time users. ✈

See the Source Guide on page 152 for manufacturers' contact information.

BY DAVID JOHNSON > PHOTOS BY DAVID JOHNSON & JAIME JOHNSTON

1/4-scale FOKKER E.V.

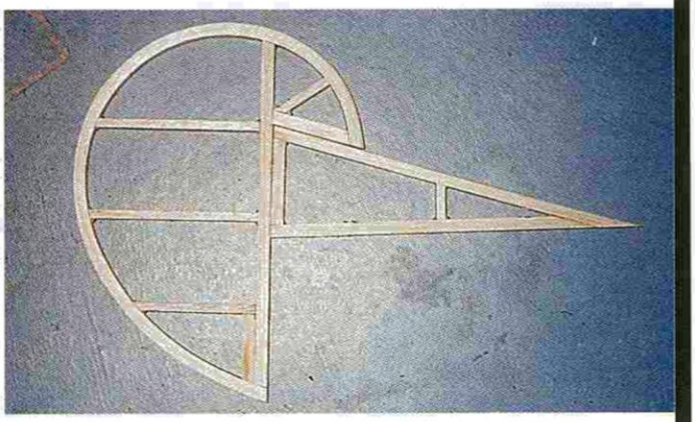
Famous WW I German parasol fighter

THE FOKKER E.V WAS THE LAST FIGHTER BUILT by Anthony Fokker for the German Fliegertruppe. It had a plywood-covered, fully cantilevered, parasol-wing configuration.

The E.V was introduced just in time for the 1918 Second Fighter Competition, in which it was regarded as the best rotary-powered competitor. The E.V. had outstanding maneuverability and was nicknamed the "Flying Razor." Several early E.V.s suffered from a weak wing construction, but newer versions featured strengthened wings and were designated "D.VIII." Introduced too late during WW I, they never had a chance to distinguish themselves in combat.

My 1/4-scale model is designed around the popular Zenoah G-38 engine. I tried to keep it uncomplicated while maintaining a relatively accurate scale outline. Let's get started.

Construction of the horizontal stabilizer and elevator is straightforward. The elevator has a laminated outline.



The rudder also has a laminated outline.

TAIL SURFACES The stabilizer is pretty straightforward; the outline pieces are made of 3/8-inch balsa, and the crosspieces measure 1/4x3/8 inch. For the elevator halves, use laminated outlines that you form around pins stuck around the elevator top-view plans. Place the pins every 1/4 inch or so to maintain an accurate shape. I used Elmer's carpenters' glue to build up the six balsa layers. Laminate all the layers together first, and then work them into place as if they were a solid piece of wood. Wrap them around the pins, and use more pins on the outside of the laminations to hold them in place. Leave the piece alone for at least 24 hours.

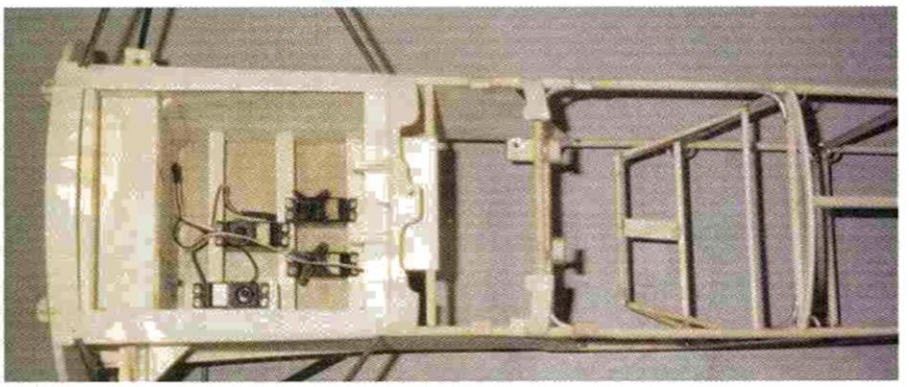
After the lamination has dried, complete the elevators by adding the straight, inner crosspieces. The rudder is built in the same way.

WING Build the wing upside-down over the plans. Start by making the two, upper, one-piece 1/4-inch-square basswood spars. Use a scarf joint as shown on the plans to join the spar sections, and install a basswood doubler between the two outboard R2 ribs at the joint locations shown on the plans. Place the two spars over the plans (doubler side up), and place the scarf joints as shown on the plans. Glue all the ribs into place on the front spar, and then glue the basswood spars into the wing center panel. Now glue the lower front spars into the outboard sections. Roll the wing back so that the ribs fit onto the rear upper spar, and tack-glue the upper

Quarter-inch balsa sheet is used in the cutout area of the wing's center section.

The wing is built upside-down on the plans. Here, the center section's main spars have been added.

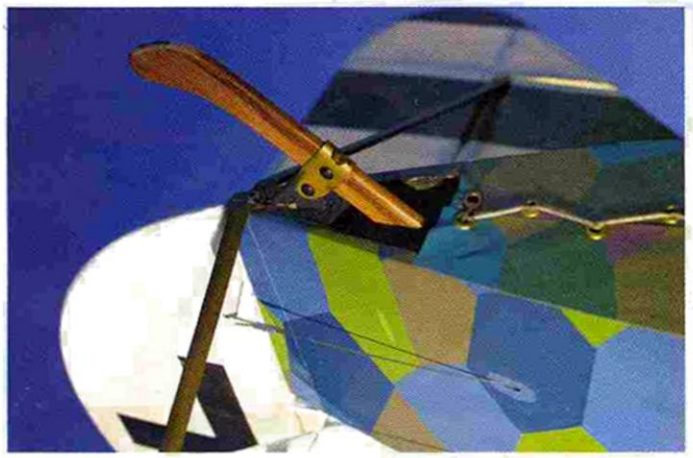
The completed wing has been sheeted and finished with dope and sealant. The rib "tapes" are strips of tissue.



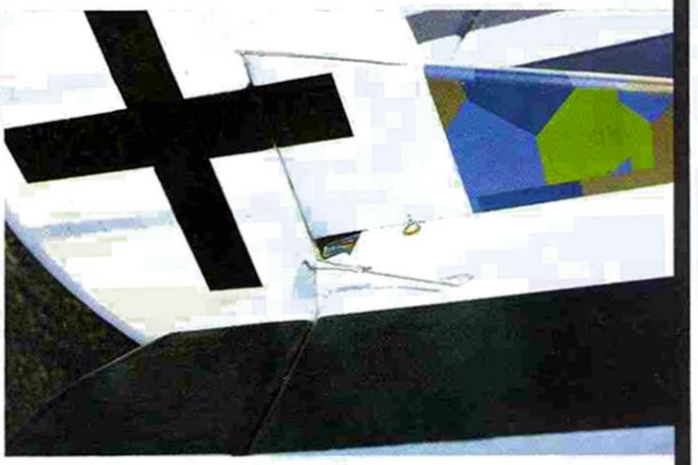
The fuselage is a very simple structure. Here, the cabane-strut wires have been installed and are held by grooved hardwood blocks.

SPECIFICATIONS

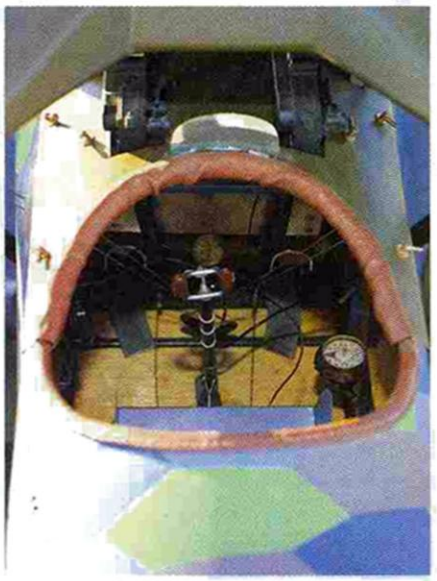
MODEL: Fokker E.V.
TYPE: WW I parasol-wing fighter
SCALE: 25%
WINGSPAN: 84 in.
LENGTH: 51 3/8 in.
WEIGHT: 14 lb.
WING AREA: 1,162 sq. in.
WING LOADING: 25.8 oz./sq. ft.
RADIO REQ'D: 4-channel (rudder, throttle, elevator, aileron)
ENGINE USED: Zenoah G-38
PROP USED: Zinger 20x8



The Fokker's tailskid is functional and uses rubber bands to absorb shock. Notice the eyelets and lacing on the bottom of the fuselage.



All the tail-control surfaces use pull-pull cable control.



A scale cockpit interior is not required, but it does enhance the model's appearance.

spar into place with thin CA. Now glue in the lower, rear, outboard spars. Remove the wing from your workbench, check the structure for warping, and then reglue all the joints with carpenters' glue.

Add the leading and trailing edges and then add the balsa sheet to form the center-section cutout and the trailing edges at the aileron areas. Sheet the bottom of the wing with 3/32-inch balsa, doing the center section first and then the outboard panels. Don't induce any warps into the wing structure. Flip the wing over, and epoxy the lite-ply strips at the strut-attachment locations. Install the aileron servos. I installed my servos permanently, but you can cut hatches in the wing bottom if you want. Route all the servo wires to one of the front strut attachment points.

>FUSELAGE Build the side frames (one on top of the other), and put wax paper between them to keep them separate. Cut the crosspieces to length, and position the two side frames upside-down and vertical over the plans. Install the front three crosspieces (top and bottom), and make certain that the structure is square. You'll remove the lower front crosspiece later. Pull the tail posts together while making sure that the stabilizer area is properly aligned with the plans. Once the glue has dried, flip the fuselage over and install formers 1 through 4. Then install C1 through C4, as shown on the plans.

To install the wing struts, place grooved blocks (grooved side down) into their correct positions, cut them to match the contours of the top formers and then epoxy them into place. Cut 1/8-inch plywood to fit beneath the blocks and the fuselage sides, and epoxy them and the 1/2-inch triangle balsa stock into place for reinforcement. Run a 3/16-inch drill bit through all the strut locations to clean excess epoxy out of the grooves.

Bend the cabane-strut wires to shape, tape them together, and slip no. 8 wire terminal connectors onto their ends. Place the wing on top of the cabanes and check its incidence; make sure that the connectors fall roughly into the correct attachment area under the wing. I brazed the cabane wires together, but you can bind them with thin wire and silver-solder them together if you wish.

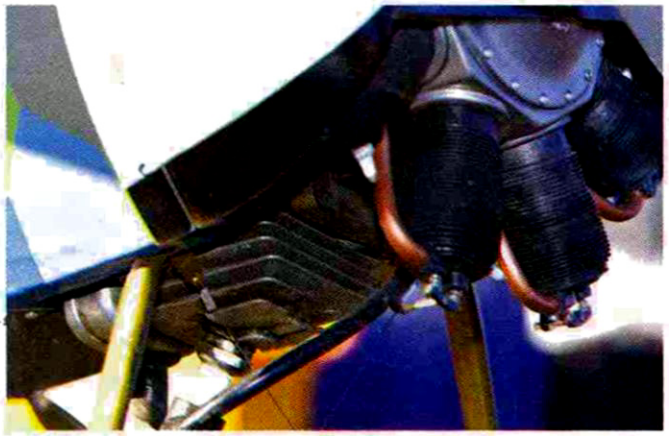
Epoxy the landing-gear blocks into place; then, from the cockpit forward, sheet the fuselage top and then the rear turtle deck and side cheeks, as shown on the plans. Sheet the bottom of the fuselage from the rear landing-gear block to the rear of the cockpit. Leave the area between the firewall and the rear landing-gear block open to allow access to the fuel tank and your radio gear. After you've covered the model, this area will be covered by an aluminum panel.

>WING INSTALLATION Put the wing upside-down on your workbench, and mark the attachment-bolt locations for the cabanes. Put the fuselage on top of the wing, and line up the strut holes as closely as possible to their marked positions. Make sure that the distance from the tail post to each wingtip is the same. Drill through the strut mounts and into the wing, and then install the 8-32 blind nuts. Drill one hole at a time, and secure each strut with a nut and a bolt as you go. This helps to maintain the proper hole alignment. When the wing is completely attached to the cabanes, check its alignment again and sheet the top of the wing.

Sand the leading edge to shape, and then glue the wingtips into place. Add scrap filler to the front of both tips, and sand the bottom of each until it's flush with the bottom of the wing. Sheet the wingtips with balsa. Once the glue has dried, cut and sand the balsa to match the wing's top contour. Sand the wing sheeting carefully, as you won't be adding covering; the finish is just dope and paint.

COMMENTS

This WW I fighter is easy to build, and it flies like an advanced trainer. Traditional balsa, spruce and plywood construction is used throughout, and the wing is fully sheeted. Pull-pull cable control is used for all control surfaces.



Here are the cylinder head and the spark-plug wire of the G-38 that's behind the dummy rotary engine.

Machine guns really add to a WW I fighter's realistic looks. These are from Williams Bros.

AILERONS The ailerons are fairly straightforward to make. Match the aileron's leading-edge angle to that on the ribs by setting the correct angle on your band saw before you cut the leading-edge pieces. When you've built the ailerons, install hinges and trial-fit them into place. The remaining tasks associated with the fuselage are pretty easy to do. Install the top decking at the front and the rear of the fuselage. Glue the decking into place, starting from the central stringers and working outward.

LANDING GEAR AND SUB-WING Bend the landing gear as shown on the plans, and screw it to the attachment blocks. Build the sub-wing onto the bottom sheeting, and then add the leading-edge material. Don't sheet the top until you've made the axle assembly.

To properly set the sub-wing's incidence, prop up the tail until the main wing incidence is at -2 degrees. Then epoxy the legs to the sub-wing and the angled ribs. Add basswood pieces as reinforcements for the outside of the gear struts. Now sheet the top of the sub-wing and sand the leading edge to shape.

FINAL ASSEMBLY Put the 24-ounce fuel tank into position, and then install the radio gear. Install the battery and receiver as far forward as you can. Install the rudder and elevator servos underneath the pilot seat. If you don't add a scale interior, install the servos as far forward as they can go. I glued the aileron extension wires to the left rear cabane-strut wire, and then I covered the struts with balsa.

I used Arizona Model Aircrafters' four-color lozenge fabric, but the choice of covering is up to you. The aluminum engine cowl is also from Arizona Model Aircrafters.

Hook up the throttle linkage, and install the pull-pull rudder and elevator control cables and linkage. I made my wheels from scratch, but you can get a nice set from Flair Products.

RECOMMENDED CONTROL THROWS

Ailerons: 1 inch up and down.
Elevator: 1½ inches up and down.
Rudder: as much as you can get, left and right.

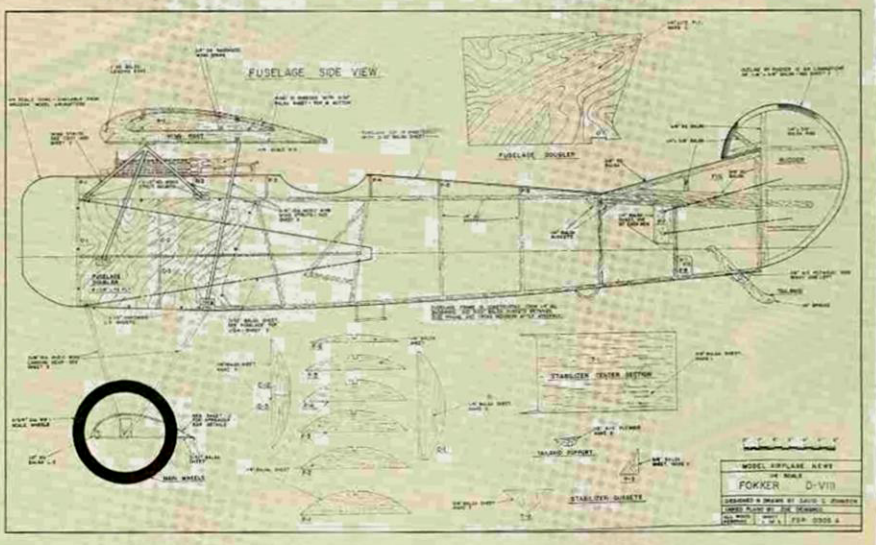
FLYING

My Fokker E.V.'s first flight was on a cold February morning. Even my trusty G-38 didn't want to run in that weather, but I kept cranking, and it eventually roared to life. I advanced the throttle to about ¾, and the plane jumped into the air. It's very stable and needed only a bit of down and left rudder-trim correction. For landing, set up the final approach for a steady, gradual descent. Keep a little power until the end of the runway is under the model, and then flare and pull the power back to idle just as the model touches down. Stay on the controls during the rollout, as the plane is rather top-heavy, and you don't want it to rock from side to side. Overall, the E.V. is easy to build, and it handles like an advanced trainer. If you want to get into WW I aircraft but you don't want the hassle of building a biplane, the Fokker E.V. parasol is the answer. What are you waiting for? Start building!

See the Source Guide on page 152 for manufacturers' contact information.

¼-SCALE FOKKER E.V.

TO ORDER THE FULL-SIZE PLAN, TURN TO PAGE 148, OR VISIT RCSTORE.COM ONLINE.



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AG-AIRCRAFT PLANS. Pawnee, Agwagon, Pawnee Brave, Transavia Airtruk/Skyfarmer, Fletcher FU-24, Cropmaster and more. Hardware paks, colour photo paks, free documentation. Catalog/price list: $5 (U.S.); VISA/MC. New Zealand Aero Products, 34 Ward Parade, Stirling Point, Bluff, New Zealand. Mobile: +6427-427-1843. [5/05]

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WANTED: UNIMAT AND WATCHMAKER LATHES; early microprocessors: KIMs; SYMs; AIMs; SOLs; robots and Atmos clocks. John Rawley, 1923 Susquehanna, Abington, PA 19001; (215) 884-9220; johnR750@aol.com. [6/05]

CUSTOM VINYL RC DECALS AND GRAPHICS. Economical, RC-Decals.com; RC-Decals, P.O. Box 690451, Charlotte, NC 28227. [12/04]

VECTORFLIGHT: ARF-quality airplanes made in Canada/USA; Extra 300S, Edge 540, Sukhoi SU31; for 0.60 to 1.00 engines. Online info and ordering at vectorflight.com. [12/04]

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QUARTER-SCALE FLEET MODEL 2 BIPLANE AND ⅛ ELECTRIC FLEET KITS. Concept Models, 6505 Urich Terrace, Madison, WI 53719. SASE for details; mailbag.com/users/conceptmodels; (608) 848-4108. [2/05]

INVESTORS—Historical stock price range data 600+ companies; $30. Check/money order. Robert Lardiere, P.O. Box 110261, Nutley, NJ 07110. [12/04]

HYDE CUSTOM SOFT MOUNTS—Independent engineering testing conclusion: "Single Isolator Hyde Mounts" considerably extend the life or completely eliminate failure of crankshaft, rod, and crankcase of both large and small single- and multi-cylinder engines. Enjoy 500 to 1,500 flights on servos, pots, gears, etc. For all DA, 3W, ZDZ, BME and others. 140+ types, styles, sizes for engines .049 to 20ci 3 yr./3,000 flights guarantee. "Plus, "double refund trial offer" $64.95 to $344.95 + $10 S&H (-25% for many undrilled versions). "Info/orders: Merle Hyde, (702) 269-7829; email: HydeSoftMounts@mymailstation.com. [2/05]

BOB'S AIRCRAFT DOCUMENTATION 2003. World's largest commercial collection of aircraft photos (400,000) and 3-view line drawings (38,000). 272-page catalog—$10; Canada, Mexico, Alaska, Hawaii & Puerto Rico—$12; international—$20 (includes air postage). 3114 Yukon Ave., Costa Mesa, CA 92626; (714) 979-8058; bobsairdoc.com. [5/05]

R/C FLIGHT INSTRUCTION in North Central Georgia Mountains "Blairsville"; (706) 745-8667. [9/05]

JETS, JETS, JETS. Ducted-fan jet kits. Fly an F-15 Regal Eagle with a .61 engine; rcjets.com. [2/05]

COMPOSITE KITS TO REPLACE BROKEN ARFs—$15 TO $65. For catalog, send two stamps to Willairco, P.O. Box 57, East Palatka, FL 32131; (386) 546-3222. [2/05]

TURN YOUR AIRPLANE AND ROCKET DESIGNS INTO CASH! We laser-cut your designs for small or large production requirements. Please visit laserimageworks.com. [5/05]

VINCE MILLER PLANS AVAILABLE AGAIN. Send $2 for brochure to Calvin's Classic Plans, 3704 Drumm Ave., Independence, MO 64055. [3/05]

HOBBYIST

FREESTYLE 45 looks great, lands gently and performs superior aerobatics. Photo in December issue's "Pilot Projects." Easier self-jigging construction, rolled AutoCAD drawings, detailed building guide and materials list plus bonus drawings; only $22.95 plus $6.95 S&H. Email LLCRCAERO@yahoo.com, or call (860) 739-6846 for full description and photos. [2/05]

GOT A BOOK MANUSCRIPT, BUT NO PUBLISHER? Tell me about it at kleinpub@comcast.net. [12/04]

FOR SALE: 35-year collection of model aircraft plans. Large, small, twin, singles, floatplanes, amphibians, flying boats, fighters and oddballs. Send SASE for a complete list and prices. W.G. Warner, P.O. Box 55, Gulliver, MI 49840. [1/05]

FOR SALE: SUPER CYCLONE (PRE-WW II) & ROCKET MOTOR ignition engines, Arden 19 glow engine, excellent fins & compression; $275 (3). "Air News Yearbook" Vols. 1 & 2 (WW II); best reasonable offer. Bob Cowherd Sr. (315) 655-3864 'til 9 pm Eastern time. [2/05]

BACK ISSUES, MODEL MAGAZINES 61 Coach, Glastonbury, CT 06033-3237; davidbrown46@cox.net. [3/05]

P47D THUNDERBOLT ⅛-SCALE MODEL. Built from Aerotech Models Inc. kit. Completely finished MUSEUM-QUALITY replica of "BIG ASS BIRD." Brison 4.2 engine/custom muffler, dummy radial, Robart air retracts, main wheel and tailwheel, all servos installed/Airtronics PCM receiver, ignition and receiver batteries. Full cockpit and pilot, sliding canopy, display prop. Never flown, but ready to fly! Pictures available. Best offer over $4,500, FOB Carson City, NV. F.E. Chase, 1520 Goldfield Ave., Carson City, NV 89701; email fechase@aol.com. (3/05)

R/C VIDEO: featuring aerial views from the pilot's seat; ⅓-scale J-3 Cub, ⅓ Beech Staggerwing and more! 90 minutes; VHS tape—$7.50; DVD-R—$10. Send check to Raymond Keel, 1200 E. Davis St., Ste. 115, Box 192, Mesquite, TX 75149.[4/05]

USED ENGINES WANTED: pre-1970 preferred. T. Crouss, 100 Smyrna, West Springfield, MA 01089-1706; (413) 732-3859. [5/05]

VAC-U-FORM SHEETS. Predrilled plastic sheets for 1960s Mattel VAC-U-FORM. Send SASE for list to: Callari Modelworks, P.O. Box 25344, Rochester, NY 14625, or email: modelwks@rochester.rr.com. [1/05]

WANTED: A COMPLETE SET OF PLANS (5 sheets) for Richard Barron's classic Boeing Stearman 96-in.-wingspan PT-13. I recently bought this model 80% completed and want to finish building it. Gerald L. Norway, 189 S. 2nd St., Fulton, NY 13069; (315) 593-8045. [2/05]

BY JOHN REID

Eagle Tree Flight Data Recorder 2

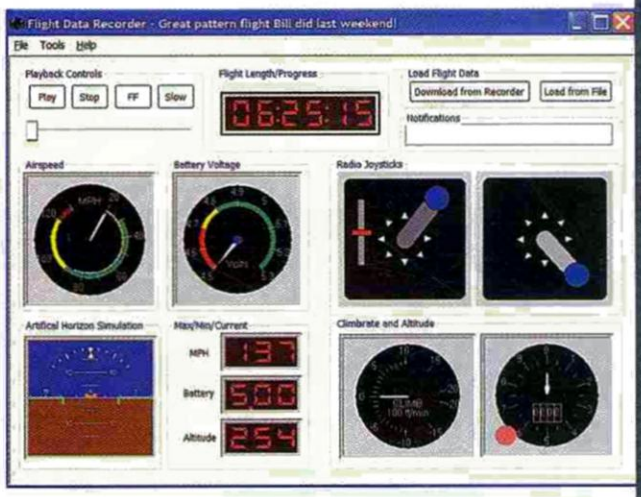
Real-time information you can use

Real-time telemetry gives you the necessary information to know what's happening on board your model—a good thing when you're flying on the edge!

WOULDN'T IT BE GREAT TO monitor your airplane's flight systems while it is in the air? Now you can monitor 16 channels of critical flight data (real-time telemetry) with the Eagle Tree Flight Data Recorder 2 and the Seagull Wireless Telemetry Dashboard System. These new systems allow you to monitor airspeed, altitude, engine rpm and temperature, the model's climb and descent rates, servo positions, the number of servo glitches, receiver battery-voltage levels and more. Let's take a closer look!

The system's main components include the Flight Data Recorder 2 program on CD, the Seagull Data dashboard, the Seagull wireless telemetry transmitter (left, foreground) and the flight data recorder (right, foreground).

The Seagull Wireless Telemetry System comes with the real-time dashboard and a telemetry transmitter, a flight-data recorder, a USB cable, a Pitot tube, a temperature sensor, an rpm sensor, Y-harnesses, four tiny magnets, a CD-ROM and an instruction manual. The Data Dashboard measures 3.5x2.5x1 inches, and you can easily attach it to your transmitter or have an assistant hold it.



The computer screen can display any selection of data you wish to view. Most data parameters can be displayed either numerically or with gauges, or with a combination of both.

INSTALLATION

Installing the system is rather simple; most of the sensors are connected to the recorder with standard servo extensions. The engine rpm sensor requires you to affix two magnets to the prop hub. The magnets must be positioned 2mm away from the sensor pick-up for proper operation. I used high-temp RTV silicone sealant to attach the magnets and a 2mm-thick piece of balsa to maintain proper spacing while it dried.

The airspeed sensor uses a functional Pitot tube that must not be installed near the propwash. I installed mine on the main landing gear near the wheel pants. The engine-temperature sensor must be wrapped around the engine head. To monitor servo movement and glitches, each servo is plugged into a Y-harness that is connected to the flight-data recorder. The altitude readings, the climb and descent rates and the receiver battery-voltage levels are all monitored by sensors in the recorder. Each data channel can be assigned a programmable audio alarm. To finish the installation, I plugged the wireless telemetry transmitter into the data recorder and used Velcro® to secure them in the fuselage.

I installed the program on my laptop and used the Installation Wizard to set up the recorder. During the setup, I selected the channels I wanted the recorder to log and how I wanted that information displayed. Next, I selected the joystick mode to calibrate the servo-stick movements, and then I programmed the data dashboard.

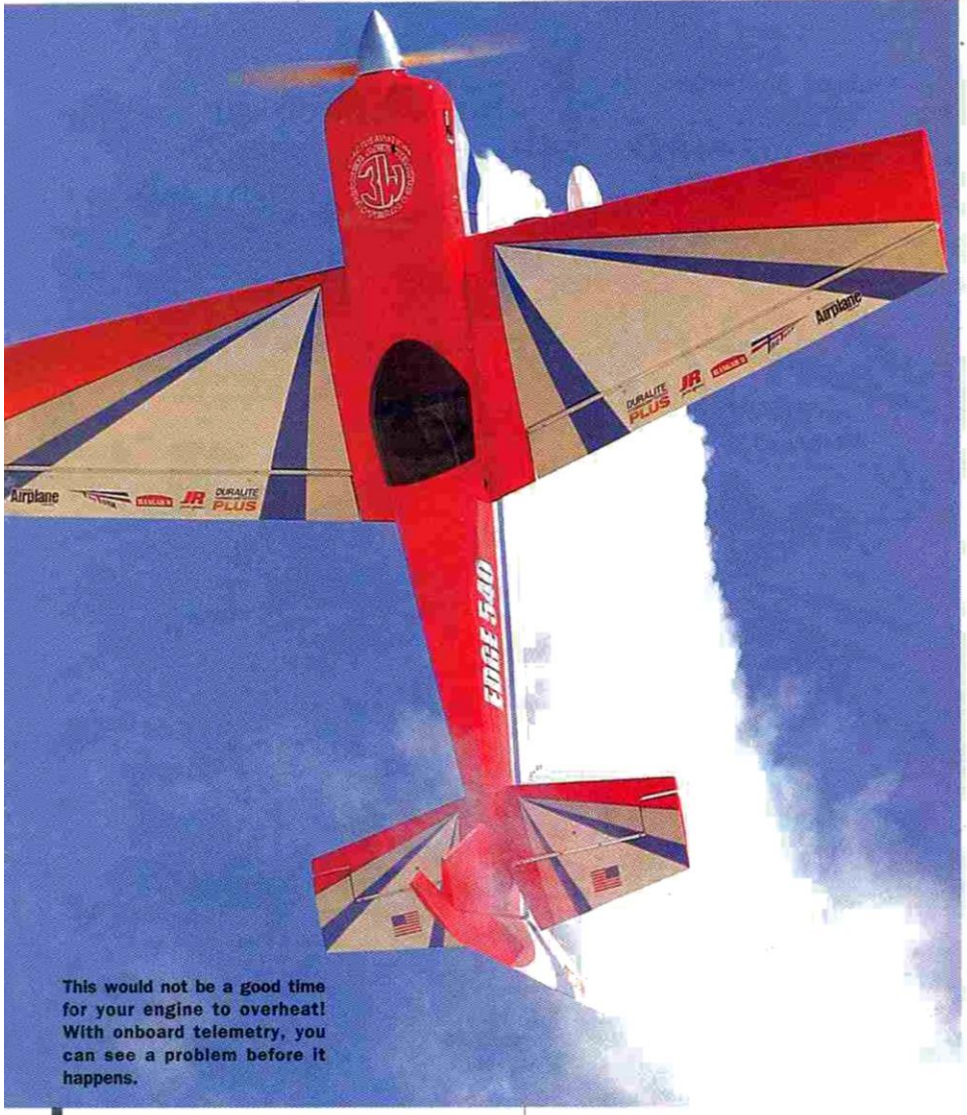
The Seagull wireless telemetry transmitter relays information to the data dashboard. Four different channels of data can be displayed on the dashboard screen at one time.

FIELD TESTING

At the field, I did a complete radio range check and tested the data recorder with the engine on and off. After I had verified everything, I hooked up the dashboard to my laptop and opened the program so I could record the flight. I set the laptop to "live" mode by clicking a button on the screen. This allows you to view the data parameters on a big screen and to record as much of it as you want.

With the plane in the air, several of my friends had their eyes firmly fixed on the

I clamped a piece of 2mm-thick balsa between the sensor and the magnets to maintain the correct gap while the high-temp RTV silicone sealant dried.



This would not be a good time for your engine to overheat! With onboard telemetry, you can see a problem before it happens.

SPECIFICATIONS

EAGLE TREE FLIGHT DATA RECORDER
OPERATIONAL VOLTAGE: 4.35 to 7 volts
CURRENT DRAW: < 35mA @ 4.8 volts
SYSTEM WEIGHT: 1.5 oz. (approx.; includes recorder, Y-cables, rpm and temp sensors and Pitot tube)
SIZE: 1.97x1.38x0.67 in.

ALTITUDE: 0 to approx. 32,000 ft.

TEMPERATURE: dual inputs, 0 deg. F to 424 deg. F
RPM RANGE: 100 to 40,000+ (approx.)

TRANSMITTER
FREQUENCY RANGE: 902 to 928MHz
MAXIMUM OUTPUT: 200mW (approx.)
SIZE: 2¾x1¼x¼ in.
WEIGHT: 0.5 oz. (transmitter only)
ANTENNA: thin, flexible stainless whip
CURRENT DRAW: average <50mA (transmitter & recorder)

DASHBOARD
SENSITIVITY: < -110dBm nominal
RECEIVER ANTENNA: thin, flexible, stainless whip
BATTERY: standard 9V
DISPLAY: 16x2-character LCD
PUSHBUTTONS: 4
USB CONNECTION: yes

COMPUTER REQUIREMENTS
The included CD-ROM is compatible with Windows 98SE, Windows Millennium, Windows 2000 and Windows XP. It is *not* compatible with Windows 98.

PRICES
Flight Data Recorder 2 (full system)—$369.99
Transmitter and dashboard (aka "Wireless Expander")—$199.99 (check website for compatibility)

screen watching the constant update of data. The screen display includes an artificial-horizon gauge that turns and shifts according to the airplane's maneuvers. During my test, I had my assistant monitor the screen and relay my control-stick movements as well as the model's attitude and altitude. He, in turn, announced the changes in data immediately after I made the maneuvers with very little lag time between the control input and the laptop screen indication. For the second flight, I disconnected the dashboard from the laptop and had my assistant monitor it during the flight. He stood next to me and relayed information during the flight.

Navigating the various screens to read the data requires only a press of a button. Each screen displays four channels of data, and during setup, you can select the parameters you want displayed on each of the five screens. The system worked perfectly during all of our flight tests! I recorded a couple of flights so that I can play that data back on my computer.

APPLICATIONS

This stuff is pretty cool, but you may wonder how you can use all this instant data at the field. For aerobatics, have an assistant monitor the dashboard to see whether you maintain a constant speed throughout your aerobatic maneuvers. Is your up-line truly vertical? Are your maneuvers too tight and putting too many G on the plane? Are you maintaining a constant attitude as the plane flies straight and level? These questions can be answered with the dashboard and the optional G-force expander.

Electric fliers can monitor the power and performance provided by different battery/motor/gearbox/prop combinations. Which prop works best with which motor? Which prop/gearbox combination gives your plane the best speed while pulling the fewest amps? Using the dashboard and the optional electric expander, you get the information in real time.

Pylon racers can monitor their planes' performances throughout a race. G-force info can help racers fine-tune their turns around the pylons, and the engine temperature data will tell them whether it's running too lean. Instant feedback provides critical information that can help win the race!

Glider pilots can set up audible alarms to let them know whether their gliders are about to stall, and a fast climb rate indicates thermal lift.

CONCLUSION

Eagle Tree's Flight Data Recorder 2 and the Wireless Dashboard Telemetry System benefit pilots who want to improve their models' performances by monitoring in-flight data feedback. Seeing minor problems as they arise allows you to prevent major problems that can greatly affect aircraft safety. Priced at $369.99, the system is well worth the investment. It works as advertised and is just too cool to watch!

See the Source Guide on page 152 for manufacturers' contact information.

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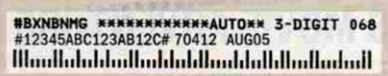

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BY MOLLY O'BYRNE ➤ PHOTOS BY DAVID GOLDBERG

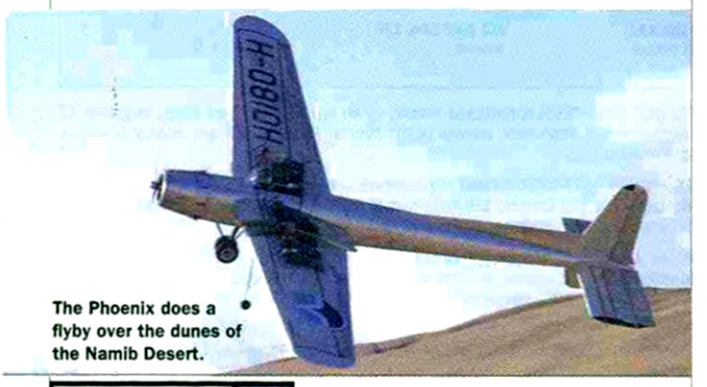
RC pilot Michael George (far left) expertly pilots the model Phoenix in the Kuiseb Canyon of Namibia.

"Flight of the Phoenix" rises again—

RC MODELS HELP RE-CREATE A FAMOUS MOVIE ADVENTURE

The London Models crew prepares the model for its flight.

A low flyby for the camera.



The Phoenix does a flyby over the dunes of the Namib Desert.

click trip MODELAIRPLANENEWS.COM FOR MOVIE CLIPS & MORE INFO

RELEASED IN 1965, THE FILM "The Flight of the Phoenix" is an exciting story about plane-crash survivors who find themselves stranded in the Sahara Desert with lots of airplane parts, no working radio and a limited supply of water. One of the men claims to be an aircraft engineer who can re-jigger all of the broken parts into a working airplane that will fly them to safety, and therein lies the tale.

This film was remade and released in 2004 after a lengthy shoot in Namibia, Africa. There, a representative of 20th Century Fox contacted South African company London Models for a quote on building a ⅓-scale fuselage of a C-119 Fairchild Flying Boxcar for the movie. When the studio rep visited the London Models workshop and saw all of the RC models there, he ended up ordering not only the C-119 fuselage but also three ⅛-scale, RC flying models of the Phoenix.

According to David Roberts of London Models, his company used studio-supplied drawings of the Phoenix to construct a full-size, undetailed test model. He reports that the aircraft was "... highly nonsymmetrical, and to get it to fly true, we offset the engine 4.5 degrees right, the subfin 2 degrees right and changed the wing section to semisymmetrical at 2 degrees incidence with 2 degrees washout.... As the elevators were different sizes, we moved the smaller one about 20 percent further than the larger one so that no roll input was generated. CG was set up at 28 percent, since we were very wary of getting into a spin. To launch, two of our best runners steadied the tips as the plane accelerated, and on releasing, we found that aileron and rudder would hold the aircraft steady and straight with virtually no input. We now felt confident to test-fly."

The two "hero" model planes were then constructed using all the patterns, molds and jigs as in the prototype, and all the details were added. The seven replica "actors," created by American Ray Cavalluzzi, had to be fitted to the top of the wings, so lift and drag were of huge concern. Happily, all the models flew straight and true with almost no trim changes required.

When shooting began in the Namibian desert, 22-year-old RC pilot Michael George would jump into a dune buggy and be transported to the flying area, where the cameras were set up, and he would then scoot back to the takeoff point to effect the landing.

David Roberts told *Model Airplane News*, "It was a thrill of a lifetime to work on a project like this!" ✚